Study on Computed Tomography (CT) Guided Transthoracic Fine Needle Aspiration Cytology (FNAC) in the Diagnosis of Intrathoracic Mass Lesions - Not Approachable by USG

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ABSTRACT

Background: Intrathoracic mass is a general issue encountered by the physicians in whole world including Bangladesh. Accurate diagnosis is important for proper management. Percutaneous fine needle aspiration cytology (FNAC) has been extensively utilized and widely accepted as an important means of diagnostic technique. This study was performed to know and justify the computed tomography (CT) guided FNAC as a diagnostic modality for the diagnosis of intrathoracic masses which are non-approachable by ultrasonography (USG).

Methods: It was a descriptive type of cross sectional study and conducted among 30 patients having ultrasonologically non approachable intrathoracic masses during the period of Feb 2016 to July 2016 in Combined Military Hospital (CMH), Dhaka considering selection criteria and informed written consent using purposive sampling technique. FNAC was done in all the patients. After further investigation, a definitive diagnosis was made. The analysis of the surgical specimen, the biopsy, the therapeutic response, and the clinical follow-up all contributed to the ultimate diagnosis. A comparison was done between the cytological and final diagnosis for thirty cases. Ethical issues were properly addressed.

Results: Initially CT guided FNAC was carried out on all patients. Conclusive cytological diagnosis was possible in 28 patients yielding 93.33% diagnostic accuracy. FNAC diagnosed 24 cases as malignant intrathoracic mass, 04 as benign lesion and 02 undiagnosed due to inadequate tissue material. In final diagnosis 25(75%) diagnosed as malignant and 05(25%) diagnosed as benign. Diagnosis of two patients was impossible by FNAC due to inadequate tissue material.

Conclusion: CT guided FNAC of intrathoracic mass allow early diagnosis with lesser trauma and lower cost. This procedure avoided more invasive diagnostic surgery.

Keywords: CT guided FNAC, Intrathoracic mass, USG approachability

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INTRODUCTION

Lung masses can be caused by a wide range of pathological disorders, including neoplastic, inflammatory, congenital, and other miscellaneous lesions. By using computed tomography (CT) guidance, more invasive methods can be avoided and nearly any part of the lung can be biopsied with a high level of safety and low morbidity.[1]

With the improvement of resolution in ultrasonic equipment & its puncture probe, ultrasonologically guided fine needle aspiration biopsy has been used as a diagnostic procedure in the diagnosis of peripheral lung lesion.[2] On the other hand before the availability of CT, central lesions are usually diagnosed by invasive bronchoscopic biopsy followed by histopathological examination.[3] For this, the specific diagnosis of a central pulmonary lesion is often difficult to make & often a lapse of long period of time increases the risk of the lesion becoming incurable.

Fine needle aspiration is a method of taking cytological sample by using a fine needle with attached syringe. FNAC of superficial masses has been quite popular and advantageous for cellular diagnosis. Similarly FNAC of deep organ is a very useful diagnostic technique, which needs the help of ultrasonography (USG) or computed tomography (CT scan) as a guidance to perform it.[4]

Computed tomography (CT)-Guided biopsy was first described by Haaga and Alfidi in 1976, and numerous papers since then have demonstrated the accuracy and effectiveness of the FNAC approach. It has been observed that the diagnostic accuracy for malignant illness is higher than 90%.[5]

It is generally acknowledged that image guided needle biopsy (IGNB) is a reliable and secure method for obtaining tissue from bulk in practically any part of the body for cytological and histological analysis.[6] For biopsies of masses located deep within the abdomen, pelvis, and retroperitoneum, computed tomography (CT) has been the preferred guiding approach in the United States. This has been especially true for masses with diameters of less than two to three centimeters. Contrarily, ultrasound has typically only been used in large, superficial areas.[7-11]

When diagnosing thoracic tumors that are not accessible by ultrasound, CT-guided trans-thoracic needle aspiration cytology with a 20-gauge spinal needle is a very specific and sensitive procedure with excellent diagnostic accuracy that may be done safely outside. Needle aspiration can routinely be done in lesions as small as 1-2 cm, irrespective of their location.[12]

However some researcher recommended further studies to validate this useful method. In Bangladesh, diagnosis of central pulmonary lesion by CT guided FNAC is done in very few medical centers only. The field of CT guided FNAC is relatively new in our country. Moreover, no such study has yet been done in Bangladesh regarding its efficacy and it is yet to be known if this method is useful in our country with our current knowledge, skill and available equipments.

In order to identify and validate CT guided FNAC as a diagnostic technique for intrathoracic masses that are not amenable to USG access, this study was conducted.

MATERIALS AND METHODS

This cross-sectional study was done at the Department of Radiology and Imaging, Combined Military Hospital, Dhaka during the period of Feb 2016 to July 2016. A total of 30

patients irrespective of their age, sex and occupation, who presented with intrathoracic mass lesion not approachable by ultrasonography were included in this study and subjected to FNAC. Informed written consent was taken from the patients and data were collected by using purposive sampling technique. Initially CT guided FNAC was carried out in 40 patients. Contact could not be possible with 10 patients regarding their final diagnosis yielding response rate 75%. All patients were evaluated to reach a final diagnosis. Clinical follow-up, examination of the surgical specimen, biopsy using a bronchoscope or a true cut needle, confirmation of the initial diagnosis made elsewhere in the body, and treatment response all contributed to the final diagnosis. A comparison was done between the final diagnosis and the cytological diagnosis for thirty cases. Using statistical analysis, the sensitivity, specificity, accuracy, positive, and negative predictive values of benign and malignant lesions were investigated separately. Ethical issues were properly addressed.

RESULTS

Data were collected from all 30 patients who were enrolled in this study.

Table-I: Age distribution of intrathoracic mass (n=30)

Age group (years)	Frequency	Percent
25-35	02	6.66
36-45	04	13.33
46-55	04	13.33
56-65	16	53.33
66-75	04	13.33
Total	30	100.00

Above table shows that among 30 patients with intrathoracic mass, the age range is 25-75 years with highest number of patients are in the age group 56-65 years.

Table-II: Sex distribution of intrathoracic mass (n=30)

Sex	Frequency	Percent
Male	26	86.66
Female	04	13.33
Total	30	100.00

Above mentioned table-II reveals that out of 30 patients of intrathoracic mass, there were 26(86.66%) men and 04(13.33%) women.

Table-III: Occupation of patients with intrathoracic mass (n=30)

Occupation	Frequency	Percent
Farmer	12	40
businessmen	08	26.66
Service	06	20
Housewife	04	13.33
Total	30	100.00

Table-III shows that out of 30 patients highest number 12(40%) of the patients were farmers followed by businessmen 8(26.66%), service 6(20%), house wife 4(13.33%).

Table-IV: Sites of intrathoracic mass (n=30)

Site	Frequency	Percent
Pulmonary	24	80
Mediastinal	6	20
Total	30	100

Table-IV depicts that out of 30 patients, lesions in highest number of patients had pulmonary lesions 24(80.00%) followed by mediastinal 6(20.00%).

Table-V: CT guided FNAC findings of intrathoracic masses (n=30)

Findings	Frequency	Percent
Squamous cell carcinoma	08	26.66
Adenocarcinoma	06	20
Small cell carcinoma	02	6.66
Non-Small cell carcinoma	06	20
Metastatic carcinoma	02	6.66
Benign lesion	04	13.33
Non diagnosed	02	6.66
Total	30	100

Above mentioned table-V shows that out of 30 patients 24(80%) were diagnosed as malignant, 04(13.33%) as benign and 02(06.66%) of the FNAC results were inconclusive due to insufficient tissue material. The highest number of patients 08(26.66%) had squamous cell carcinoma followed by adenocarcinoma 06(20%), non-small cell carcinoma 06(20%), small cell carcinoma 02(06.66%) and metastatic carcinoma 02(06.66%). Out of four benign lesions three had tuberculosis and another one had fungal infection.

Table-VI: Final diagnosis based on intrathoracic masses (n=30)

Findings	Frequency	Means of eventual diagnosis
Squamous cell carcinoma	09	Open biopsy/ Therapeutic response/ Bronchoscopic biopsy
Adenocarcinoma	06	Open biopsy/ Therapeutic response /Bronchoscopic biopsy
Small cell carcinoma	02	Therapeutic response
Non-small cell carcinoma	06	Therapeutic response
Metastatic carcinoma	02	Same diagnosis made elsewhere in the body
Benign lesion	05	Therapeutic response
Total	30	

Table-VI denotes that, in final diagnosis 25 patients were diagnosed as malignant and 05 diagnosed as benign. The highest number of patients (09) had squamous cell carcinoma, followed by adenocarcinoma 06, non-small cell carcinoma 06, metastatic carcinoma 02, small cell carcinoma 02 and benign lesions 05. Out of 05 benign lesions 04 had tuberculosis and 01 had fungal infection.

Table-VII: Complications of CT guided FNAC (n=30)

Complications	Frequency	Percent
Pain at puncture site	05	17
Small pneumothorax	04	13
Haemoptysis	01	03
No complication	20	67
Total	30	100

Above mentioned table-VII shows that out of 30 cases no complication arose in 20(67%) cases. 5(17%) cases complained pain at puncture site. A little pneumothorax was observed in 4(13%) patients. Only one instance had hemoptysis in a single episode. Nevertheless, none of the consequences required medical attention.

DISCUSSION

Research has demonstrated that using CT guided fine-needle aspiration cytology (FNAC) to diagnose intrathoracic lesions is an economical approach that can minimize hospital stays, costs, and the requirement for diagnostic thoracotomies. Accuracy is increased because lesions of all sizes and inaccessible locations guided by ultrasonography, such as the mediastinum and deep hilar area, are easily sampled.

The giving of cellular material increases when radiologists and histopathologists collaborate well. The adequacy rate of the technique is improved by a prompt review of the specimen by the cytopathologist during the FNAC procedure, and additional rechecking if necessary. This helps to save expenses and improve guidance for later diagnostic and therapeutic actions.[13]

Thirty patients of ultrasonologically non-approachable intrathoracic masses underwent CT guided FNAC. In this study, conclusive cytological diagnosis was possible in 28 patients yielding overall 93.33% diagnostic accuracy.

Out of 30 patients diagnosed as intra-thoracic mass 53.33% was in the age group ranging from 56-65 years, this age group was prevalent in terms of age. So highest number of patients in this series belongs to around 60 years age group. The current study's highest age of incidence (56–65 years) was noted in prior research by Jayashankar et al. and Mukherjee S.[14,15]

The higher incidence of malignancies in the 56–65 age group, which accounts for 80% of all cases, could be the cause of the rise in cases in that age group. According to Maxcy Roseau's most recent research, the incidence rates of the majority of adult malignancies increase exponentially with age. This is accurate given that the older population is experiencing an upsurge in malignant instances.[16]

Out of 30 cases 26(86.66%) were men and 04(13.33%) were women. This is consistent with the widely recognized fact that intrathoracic masses are more common in older adults and in men than in women. There are fewer female cases of malignant pulmonary lesions because they are less common in women in this study group (Male: Female 6:1).

The location of lesion was as follows: pulmonary 24(80%), mediastinal 06(20%). CT FNAC shows 24(80.00%) malignant cases; benign case were 04(13.33%) and in 02 cases no definite diagnosis could be obtained. CT-FNAC shows squamous cell carcinoma was predominantly 09(30.00%), next comes non-small cell carcinoma 06(20%) and adenocarcinoma 06 (20.00%), small cell carcinoma 02(06.66%), metastatic carcinoma 02(06.66%) and benign lesion 05(16.66%). Two cases remain undiagnosed. In final diagnosis squamous cell carcinoma was still predominant 09, and next to it in order of descending frequency were adenocarcinoma 06, non-small cell carcinoma 06, small cell carcinoma 02, metastatic carcinoma 02 and benign lesion 05. Open biopsy, bronchoscopic biopsy, treatment response, and the same diagnosis made elsewhere in the body were the methods used to reach the final diagnosis. In final diagnosis no change was seen in cytodiagnosis of FNAC but definitive diagnosis of 02 undiagnosed cases in FNAC could be made. The most frequent malignant tumor in this series was squamous cell carcinoma, which was followed by adenocarcinoma, non-small cell carcinoma, small cell carcinoma, and metastatic carcinoma. These results bear a strong resemblance to the 1990 study conducted by Mostafa et al. His research was haphazard, and there were more cases than.[17]

The procedure is well tolerated by all the patients. Five patients complained of pain at the puncture site, which subsided on its own without the need for medicine within a few hours (three to six hours). Just four patients (13.33%) experienced a pneumothorax following aspiration, and one patient (03.33%) experienced a single episode of moderate hemoptysis. Within ten minutes of the surgery, pneumothorax was detected in all four cases, and it was mild less than one tenth of the chest. None of these needed the placement of a chest tube. The haemoptysis noted in only one case was small and single episode and required no treatment. This study has similarities to that of Singh et al. who found no evidence of potentially lethal complications such as tension pneumothorax, air embolism, or endobronchial bleeding.[5] The complication rate is determined by the size and distance of the lesion from the

pleura. The complication rate increased with the quantity of lung tissue the needle traversed; it was inversely correlated with lesion size and directly proportionate to the distance of the lesion from the pleura. Smaller lesions had a higher complication rate. This study used a fine needle of 23G where the likelihood of complications appears to be low, which is consistent with the findings of the Zavala et al.[18] In most cases, CT guided FNAC provided a correct diagnosis of intrathoracic mass, even though in a few cases it was unable to do so. The possible reasons for under diagnosis were as follows: (a) The investigator had limited experience of this procedure as no institution routinely and academically do this in our country. (b) Location of intrathoracic mass. When a lesion is small (less than 0.5 cm), located in the subcarinal level, beneath the scapula and ribs, in the aorto-pulmonary window level, the lesion distance exceeds the needle length etc, CT guided FNAC may not be able to guarantee a reliable diagnosis (c) Additionally, the study only has a small number of cases. More people in the study could have produced more precise findings about the diagnostic validity of this approach.

CONCLUSION

This study concluded that CT guided FNAC is a useful diagnostic technique for the diagnosis of intrathoracic mass and validated the relevant previous study findings regarding its efficacy. However, further study with larger study population involving several investigators at multiple centres may give more precise results. With the advancement of technology and the growing accessibility of CT scans throughout Bangladesh, even at the district level, coupled with a gradual increase in our proficiency and experience with this technique, CT guided FNAC is anticipated to play a significant role in the initial assessment of intrathoracic masses that are not amenable to ultrasound in the near future.

REFERENCES

1. Konjengbam R, Singh NB, Gatphoh SG. Computed tomography guided percutaneous transthoracic fine needle aspiration cytology of pulmonary mass lesions. Journal of Medical Society. 2014; 28:112-116.

2. Rasmussen, Holm HH, Kristensen JK, Barlebo H. Ultrasonically guided liver biopsy Br Med J. 1972; 2: 500.

3. Javala DC. Diagnostic fiberoptic bronchoscopy: Techniques and results of biopsy in 600 patients Chest. 1975; 68(1):12-19.

4. Suen KC. Atlas and Textbook of Aspiration Biopsy Cytology. Baltimore: Williams & Wilkins.1990; 1-15.

5. Singh JP, Garg L, Setia V. Computed Tomography (CT) guided transthoracic needle aspiration cytology in Thoracic mass lesions - not approachable by USG. Indian journal of Radiology & Imaging. 2004; 14(4): 395-400.

6. David SM, Gerald DD, Christine CE. Efficacy of sonography as a guidance technique for biopsy of abdominal, pelvic and retroperitoneal lymph nodes. AJR.1996; 167: 957–62.

7. Boland GW, Lee MJ, Mueller PR, Mayo SW, Dawson SL, Simeone JF. Efficacy of sonographically guided biopsy of thyroid masses and cervical lymph nodes. AJR. 1993; 163:1053–56.

8. Charboneau JW, Reading CC, Welch TJ. CT and sonographically guided needle biopsy: current techniques and new innovations. AJR. 1990; 154: 1-10.

9. Gazelle GH, Haaga JR. Guided percutaneous biopsy of intra-abdominal lesions. AJR. 1989; 153(5): 929–35.

10. Reading CC, Charboneau JW, James EM, Hurt MR. Sonographically guided percutaneous

biopsy of small (3cm or less) masses. AJR. 1988; 151:189–92.

11. Welch TJ, Sheedy PF II, Johnson CD, Johnson CM, Stephens DH. CT-guided biopsy: prospective analysis of 1000 procedures. Radiology. 1989; 171(1): 493–6.

12. Hagga John R. Image -Guided Micro procedure CT and MRI Interventional Procedure; In CT and MRI Imaging of the Whole Body. 4th edn; 2003; 2: 2123-2183.

13. Stewart CJ, Stewart IS. Immediate assessment of fine needle aspiration cytology of lung. J ClinPathol. 1996; 49: 839–43.

14. Jaya Shankar E, Pavani B, Chandra E et al. Computed Tomography Guided Percutaneous Thoracic: Fine Needle Aspiration Cytology in Lung and Mediastinum. J Cytol Histol. 2010; 1 (3), 107–10.

15. Mukherjee S, Bandyopadhyay G, Bhattacharya A, Ghosh R, Barui G, Karmakar R. Computed tomography-guided fine needle aspiration cytology of solitary pulmonary nodules suspected to be bronchogenic carcinoma: Experience of a general hospital. J Cytol. 2010; 27(1): 8.

16. Maxcy-Rosenau-Last: Public health and preventive medicine 13 edition. Appleton and Lange; 1993.

17. Mostafa MG, Islam MN, Rahman MA et al. Unguided percutaneous transthoracic fine needle aspiration cytology in the diagnosis of the peripheral lung lesions. 1999; 25(1):1-5.

18. Zavala DC, Schoell JE. Ultra thin needle aspiration of lung in infection and malignant disease. Am Rev Respir Dis. 1981; 123(1): 125–31.