Original Article

Determination of complications in computed tomography guided fine needle aspiration cytology of lung mass

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Abstract

Introduction: The purpose of this study was to determine the complications of computed tomography (CT) guided fine needle aspiration cytology (FNAC) of lung mass.

Methods: This prospective study was done in 56 patients in Department of Radiology and Imaging, Tribhuvan University Teaching Hospital (TUTH). The CT guided FNAC was performed in patients having lung mass. The complications during CT guided FNAC were recorded and statistical analysis was done**.**

Results: Among 56 individuals 29 were males and 27 were females, age ranging from 42 to 80 years. Most of the lesions were located in upper lobe of lungs. There were no complications in 34 cases whereas 16 cases had local hemorrhage, 5 cases had pneumothorax of less than 30% and 1 case had pneumothorax of more than 30%.

Conclusion: CT guided FNAC is a safe procedure for diagnostic accuracy without significant complications.

Key words: Complication, CT guided FNAC, Fine Needle Aspiration Cytology, and Lung mass.

Introduction

In the attempt to determine the nature of pulmonary nodule (benign versus malignant), clinical data alone is not adequate. Therefore, radiological (morphological) evaluation with CT plays an important role in diagnostic algorithm. Transthoracic fine needle aspiration cytology (FNAC) is a well-established and safe technique for evaluating the pulmonary lesions.[1,2] The diagnostic accuracy has been reported as greater than 80% for benign disease and greater than 90% for malignant disease. The FNAC is often the first choice in lesions located in the mediastinum, pulmonary apex, middle and upper lobe or peripheral, especially small lesions of a few centimeters in diameter. 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 and radiologists. Even though FNAC has proven its role in the diagnosis of infections and other diffuse benign processes, the main indication remains the diagnosis of localized intra thoracic lesions suspected of being malignant, particularly when less invasive investigations prove to be negative.

CT guidance permits biopsy of nearly all lesions that are visible on CT scans. Needle placement in small pulmonary lesions or deep mediastinal nodes can be accurately performed with CT as vascular and cardiac structures are well demonstrated and safely avoided. Pneumothorax is, by far, the most common complication of the procedure. Reported rates range widely from 5% to 61%. Most of these data pertain to fluoroscopic guided percutaneous transthoracic needle biopsy.

The present study was performed to determine the accuracy and complications of CT guided FNAC at our setting. The specific objectives were to determine the relation of complication with age, sex and site of the lung mass.

Methods

This was a prospective cross-sectional study carried out in the Department of Radiology and Imaging,

Tribhuvan University Teaching Hospital, Kathmandu. The study population consists of patients presenting with lung lesions on plain x-ray and CT and referred to Radiology department for CT guided FNAC. The study was conducted from December 2014 to November 2015. The exclusion criteria were uncooperative patient, patient those who have some type of major complication ,severe chronic obstructive pulmonary disease (FEV1<30% predicted/Respiratory failure) , bleeding disorders and contralateral pneumonectomy. The study protocol was approved by the ethical committee of Institutional Review Board in Institute of Medicine and written informed consent was taken from patients.

Those patients sent for CT guided FNAC were well explained and counseled about procedure and its probable complications. Written consent was obtained. At first, plain CT scan of the region of interest was performed to determine the location, size and type of lesion. The skin entry point was marked with skin marker and local anesthesia was given with 10 ml of 2% xylocaine injection. The spinal needle (22-guage) was left for reference and axial limited scan was obtained. The needle tip position was confirmed with additional scans. Then the tissue sample was obtained and placed on the slides. Dry and wet slides were sent to the pathology department for histo-pathological study.

The punctured site was shielded with handyplast. Limited scans were performed at the area of puncture and examined for the complications in CT images. Patients were kept in observation for 1-2 hours even if there were no major complications. If any major complications were noted in post procedure scans, patients were strictly monitored under medical and surgical supervision. After 2-3 hours, patients were sent for chest x-ray to re-evaluate the status of the complications.

Estimation of size of pneumothorax was performed according to the percentage in frontal chest radiograph**.**

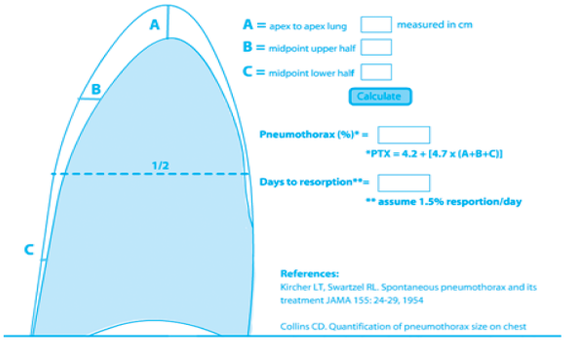

Figure 1: Estimation of size of pneumothorax

Formula for calculation of the size of pneumothorax

Pneumothorax (%) = 4.2+ 4.7 x (A+B+C)

Where, A= apex to apex lung ;B= midpoint upper half ;C= midpoint lower half

A, B and C measured in cm

The obtained data were filled in proforma. This data were analyzed with the help of SPSS version 20, descriptive analysis and Chi square test. The P-value of (P<0.05) was considered to indicate statistically significant.

Result

Out of 56 patients, 29 (51%) were male and 27(49%) were female. In the present study the distribution of age ranged from 42 to 80. The age group< 50 were less in number (10.71%) and more cases (37.5%) were in age group from 61-70 years. Our study showed that about 53.6% of mass lesions were present in upper lobe, 25% in middle lobe and 21.4% in lower lobe

CT guided FNAC showed no complications in 34 (60.7 %) cases and various complications in 22 (39.3%) cases which included local hemorrhage in 16 (28.6 %), pneumothorax < 30% in 5 (8.9 %) and pneumothorax >30% in 1(1.8%) case. (Table 1 and Fig 2,3)

Table 1: Types of complication and frequency

Types of complications	Frequency	Percentage
Nil	34	60.7
Local haemorrhage	16	28.6
Pneumothorax < 30%	5	8.9
Pneumothorax > 30%	1	1.8
Total	56	100.0

Fig. 2 , 3

The predictors of complications were calculated by using Chi-square test. The predictors of complication were done on the basis of sex of patients, site of lesion and age of patients as shown in Table **2-5**.

Table 2: Location of lesions and frequency

Locations	Frequency	Percentage
Upper lobe	30	53.6
Middle lobe	14	25.0
Lower lobe	12	21.4
Total	**56**	**100.0**

Table 3: Complication and sex of patients

Predictor	No complication	Complications Present	p-value*
Sex:			
Male	20	9	0.19
Female	14	13	

Table 4: Complications and age of patients

Predictor	No complication	Complications Present	p-value*
Age			
Less than 60	10	9	0.37
More than 60	24	13	

Table 5: Predictors of pneumothorax

Predictors	No pneumothorax N=50(%)	pneumothorax present n=6(%)	p-value*
Sex			
Male	26 (52)	3(50)	0.92
Female	24(48)	3(50)	
Age			
Less than 60	17(34)	1(16.7)	0.39
More than 60	33(66)	5(83.3)	
Location			
Upper	26(52)	4(66.7)	
Mid	13(26)	1(16.7)	
Lower	11(22)	1(16.7)	0.79

From the above table, out of 29 male patients pneumothorax was present in 3 cases and out of 27 female patients 3 of them developed pneumothorax. 5 cases of age greater than 60 years developed pneumothorax while only one case developed pneumothorax of age less than 60 years**.**

Discussion

FNAC is an accurate and safe method for evaluation of lung mass. It enables categorization of malignant lesions in majority of cases. Transthoracic fine needle aspiration cytology (FNAC) is a well-established and safe technique in evaluating the pulmonary lesions. The FNAC is often the first method of choice for evaluation of the lesion located in the pulmonary apex, middle, upper lobe or periphery especially for small 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 and radiologists. The diagnostic accuracy has been reported as greater than 80% for benign disease and greater than 90% for malignant disease.[3]

Even though FNAC has proven its role in the diagnosis of infections and other diffuse benign processes, the main indication remains the diagnosis of localized intra thoracic lesions suspected of being malignant, particularly when less invasive investigations prove to be negative. In our study, 56 cases were enrolled for CT guided FNAC in one year duration. All the cases were adult with age ranging from 42 to 80 years with mean age of 63 years. Majority of cases in our study were in age group of 61-70 years and cases of age less than 50 years were least in number.

This study showed that in 60.7% (n=34) cases there were no complications. However, various complications were present in 22 (39.3%) out of which 16 (28.6%) cases had local hemorrhage, 8.9% cases had pneumothorax less than 30% and 1.8% with pneumothorax more than 30%. In this study complication rate of pneumothorax was significantly lower than those present in the studies conducted by Bansonnenberg et al (42.7%), Stanley et al (29%), Santambrogio et al (20.9%) and Singh et al (11.8%).[4]

In our study out of 56 cases, 10.7% (n= 6) cases had post procedural pneumothorax in which 8.9% (n=5) had minor pneumothorax that did not required chest tube drainage. Whereas Prashant et al study showed minor pneumothorax in 30% (n=60) out of 200 cases that did not required chest tube drainage. In our study major pneumothorax was noted in 1.8% (n=1) and required chest tube placement. Prashant et al study showed major pneumothorax in 5% (n=10) that required chest tube drainage. In our study complications like pneumothorax was less compared to Prashant et al study. Complications like local haemorrhage was noted in 28.5% (n=16) whereas Prashant et al study showed 6% (n=12) which was less than our study. [5]

Our study showed that about 53.6% of mass lesions were present in upper lobe, 25% in middle lobe and 21.4% in lower lobe, which was different from Prashant C et al [5]. His study showed that 25% of lesions were in upper lobe, 35 % in middle lobe and 40% in lower lobe.

The ratio of male to female population in the study done by Konjengbam R et al[6] , Shrestha et al [7] , Naomi et al [8] was comparable to our study (1.07:1). There were no complications noted in 20 (68.96%) male patients whereas complications (pneumothorax and hemorrhage) were noted in 9 (31.03%) male patients. Similarly in female patients, no complications were noted in 14 (51.85%) cases whereas complications (pneumothorax and hemorrhage) were present in 13 (48.14%) cases. In our study females showed more predominance to complications. However, no other study had shown this type of result. This difference may be due to difference in sample size, duration of study and difference in population characteristics. In our study, age range of cases was 42 to 80 years with the mean age of 63.39 year which was similar to study done by Konjengbam R et al where patients were of age ranges 45- 84 year and mean age of 65.75 year. There were 37 cases of age greater than 60 years and 19 cases of less than 60 years. Out of 37 cases of greater than 60 years, 24 (64.86%) cases had no complications and 13 (35.13%) cases had complications (pneumothorax and hemorrhage). Similarly, out of 19 cases of less than 60 years, 9 (47.36%) cases had complications.

Study done by Basnet et al[9] showed that only 2 cases out of 100 had complications of pneumothorax which required the treatment. Study done by other researchers like Konjengbam R et al and Naomi et al showed chest pain, hemoptysis and shortness of breath like complications. However, no such complications were encountered in our study. This study showed that CT guided FNAC is considered safe and reliable procedure. There was no statistically significance while correlating complications with sex of patients (p= 0.19) and age of patients (p=0.37) in our study.

Conclusion

FNAC is of a definite help in diagnosing intrathoracic lesions, whether malignant, benign or inflammatory. It avoids unnecessary thoracotomy for diagnostic purpose. Out of 56 patients major complications like pneumothorax was only observed in six patients out of which only 1 patient required chest tube insertion. The complications with age , sex and site of lesions showed no significant relation in present study. CT guided FNAC is a safe procedure for diagnostic accuracy without significant complications.

Conflict of interest: None declared

References

1. Mohammad GM. CT guided fine needle aspiration cytology in diagnosis of thoracic lesions. JIMA 2001; 99(10):1-5.
2. Anupam S, Kshitish K, Manoj K. Computed tomography guided fi ne needle aspiration cytology of thoracic mass lesions: a study of 57 cases. J Cytol 2009; 26:55-9.
3. Emara MM, El-Badrawy A, Tarek AE, Mohamed EA, Hussain AY. Role of transthoracic CT guided needle aspiration cytology in difficult to diagnose benign and malignant intrathoracic lesions. EJB. 2013; 7(1):4-12.
4. Singh JP, Garg L, Detia V. CT guided transthoracic needle aspiration cytology in difficult thoracic mass lesions, not approachable by USG. IJRI 2004 Nov;14(4):395-400.
5. Prashant C, Ramachandra, Pattbhiraman, Raghuram, Attil.Feasibility V. S. S.: Safety and efficacy of the CT guided fine needle cytology (FNAC) of lung lesions. Indian J MedPaediatrOncol2007; 28 (2):16-25.
6. Konjengbaum R et al , Computed tomography guided percutaneous transthoracic fine needle aspiration cytology of pulmonary mass lesions; J Med Soc 2014; 28:112-6.
7. Shrestha MK,,Ghartimagar D, Ghosh A ,Computed tomogram guided fi ne-needle aspiration cytology of lung and mediastinal masses with cytological correlation: A study of 257 cases in Western region of Nepal. NMCJ 2014;16: 80-3.
8. Naomi Winn et al, Patient reported experiences of CT guided lung biopsy: a prospective cohort study. Respir Med. 2014; 9(1): 53.
9. Basnet S B, Thapa G B, Shahi R, Shrestha M, Panth R .Computed tomography guided percutaneous transthoracic fine needle aspiration cytology in chest masses. J Nepal MedAssoc2008; 47(171):123-7.

FIGURES

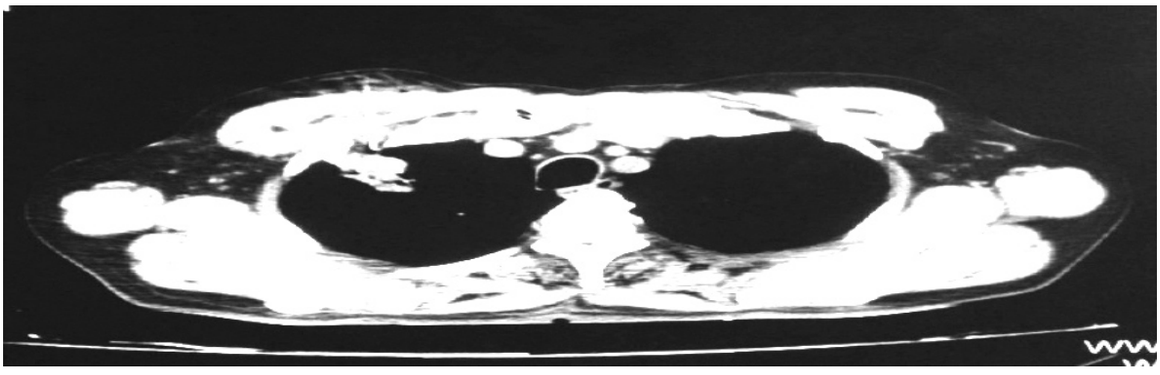

Figure 2: Needle in mass lesion during CT guided FNAC

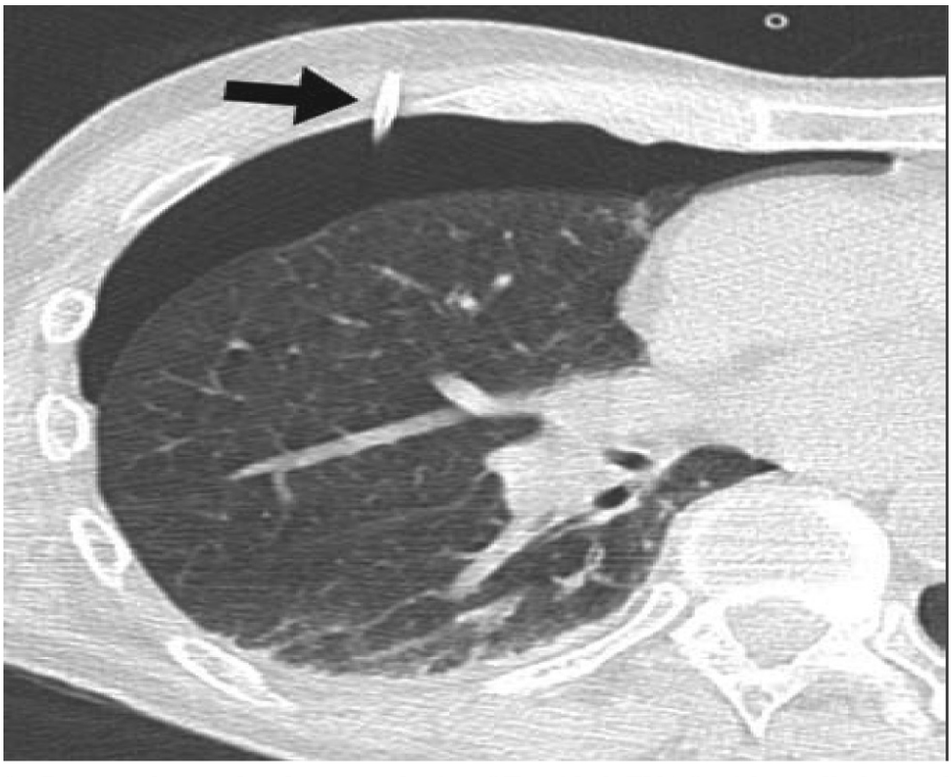

Figure 3: Pneumothorax development during CT guided FNAC with needle [arrow] in-situ