ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasound Versus Computed Tomographic Guided Fine Needle Aspiration Cytology

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ABSTRACT

Image guided FNAC of pulmonary lesions are widely applied now a days. Most of the lesions which are located nearer to the chest wall can be well visualized by ultrasonography. Whereas smaller lesions, deeply located ones, mediastinal or juxtra-hilar lesions may not be visualized sonographically. In those cases CT-guidance becomes beneficial. We report 127 FNACs done during a 2 year period. In considering the poor economic ability of the patient USG-guidance was preferred provided the lesion could be well visualized. Ultrasound guided method was successfully performed in majority of cases except a few where CT-guidance was necessary. After first aspiration an immediate cytological assessment was done by a quick staining method and in case of inadequacy of the specimen a second pass was made within an hour. Different pathological spectrum of diseases were diagnosed cytologically and was compared with their final diagnosis. Negligible immediate or late complications were noticed. Image guided FNAB of intra-thoracic masses can therefore be made with minimum complication, can allow the physician to decide the mode of treatment in a shortest possible time and in most of the cases an ultrasound guidance is sufficient enough considering the poor economic status of people in this subcontinent.

Key Words : CT Guided FNAC, USG FNAC, Diagnostic Accuracy

Introduction

There is a wide range of techniques available to examine the respiratory tract diseases. Radiology guided fine needle aspiration biopsy (FNAB) is superseding them as the diagnostic modality of choice in most patients. FNAB tends to preserve both the cells and their architectural arrangement. Whereas cells obtained by sputum or bronchial brushing techniques often show variable degrees of cellular degeneration and fragmented cell groups. FNA has been shown to be a cost-effective method of diagnosis[1] leading hospitalization, lower costs and a reduction in diagnostic thoracotomy and in studies using decision analysis[2]. Lesions of all sizes including mediastenum and deep hilar lesions are sampled with increasing flexibility and accuracy when accompanied by CT or other imaging techniques. For lesions not suitable for ultrasound guided biopsy, CT is now the preferred imaging modality[3]. Most of the larger lesions and lesions abutting the chest wall are visible through ultrasonography. Whereas, smaller lesions, deeper ones, mediastinal or hilar lesions can be accurately located by CT scan. In such cases vascular or other cardiac structures are easily demonstrated and can be safely avoided[4].

Pneumothorax is a common complication. The rate of pneumothoraces reported in the literature varies from 6 to 57 % [5] and those requiring intercostals catheterization range from 1.5 – 20 %.[6,7] Several small studies claim that the use of very fine needles may reduced the incidence, but this is

disputed by other workers. Immediate cytological assessment of material allows the number of needle passes to be reduce, and so reduces the rate of pneumothorax[8]. Other complications like pneumomediastinum, air embolism and haemothorax are extremely rare after FNA of Lung. Less than 5% of patients complain of minor hemoptysis. A small hemorrhage into the surrounding lung occurs in upto 10% of cases without being detrimental to the patient[9].

Contraindications to FNAC are unconscious or uncooperative patients or in those with respiratory failure, hemorrhagic diathesis, intractable coughing or pulmonary hypertension[10].

Having the pathologist at the procedure can reduce the number of needle passes and may decrease the rate of pneumothorax, increase the sensitivity [8] and improve the predictive value of negative results[11].

Materials and Methods

From July 2004 through March. 2006, 127 patients who were referred by general and sub-specialiy internists or oncologists with thoracic mass were examined and underwent image guided transthoracic FNAB in a private clinic of Rajshahi district. A short clinical history was taken. List of medications being taken at that time were inquired about. Relevant investigations including BT, CT, Prothrombin time test were done. Chest skiagrams were made available before aspiration. Written information was given to all patients before the procedure and informed consent was obtained in a written form from all patients and /or the attending persons.

The samples were taken by the pathologist with a radiologist present besides her. At first an ultrasonographic assessment was done. Examinations were performed using an ultrasonic unit (model 3200 SONOACE) with 3.5-MHz curvilinear array scanner. If the lesion is well visualized (Fig-1), aspiration is performed. Otherwise CT was chosen for image guidance. The patient was positioned prone or supine depending on the skin entry site chosen. A 20 gauge spinal needle (8 cm. long) with a central stylet was used. The skin entry site was sterilized with standardized antiseptic solution and the cutaneous and subcutaneous tissue infiltrated with 2% Jasocaine up to a maximum dose of 5 ml. The aspiration needle is then directed towards the lesion during suspended respiration. Presence of the needle tip within the lesion is ensured by the monitor display. After removing the stylet, a 20 ml syringe attached to a 5 cm. long soft rubber tube is connected by fitting needle hub into the free end of the tube. The plunger of the syringe is then pulled back. Continuous suction was then applied while rotating and moving the needle to and fro during suspended respiration. Aspiration was performed with real time monitoring by the USG machine.

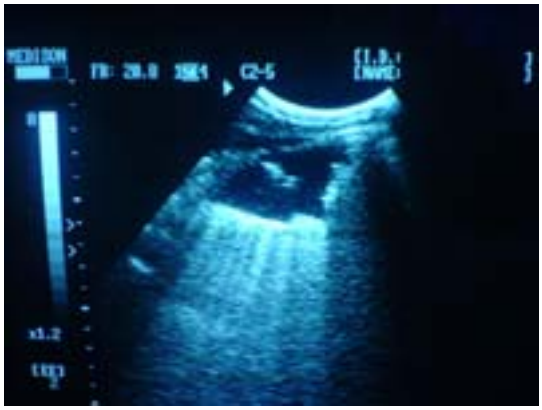

Figure 1: *Sonographic view of a pulmonary lesion abutting to the chest wall.*

The whole procedure did not take more than a minute to avoid excessive hemorrhage. The smears were made as quickly as possible to avoid coagulation of blood which hampers the smearing pattern by obscuring the parenchymal calls. Smeared slides were fixed in 95% alcohol for cytological evaluation, whereas large fragments were placed in a formalin solution for histopathological examination. Immediately after the puncture, the development of PN was detected by US examination. The Pneumothorax was characterized by the disappearance of the lung tumor. The respiratory excursions of the visceral pleura also disappeared.

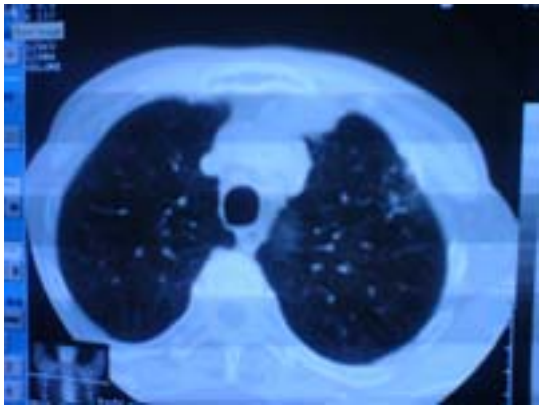

Figure 2: *Axial CT showing a small soft tissue lesion at suprahilar region in the left prevascular location.*

In cases of CT-guided FNAC, a prior axial scan of the chest was done to locate the lesion and to plan the route of needle entry(Fig 2 & 3). Model Hitachi-pronto with current tube 1.5 MHU was used. A radio-opaque marker was used for marking the puncture site. After introducing the needle another image was taken to ensure the position of the needle tip within the lesion. A third scan was done to look for any immediate complication (pneumothorax or haemorrhage) within 5-10 minutes of aspiration. Patient was kept lying on a bed for an hour to look for smear adequacy. If inadequate, a second puncture was made. Patient was advised to report within 24 hrs. in case of any physical ailness. Most of the patients who developed pneumothorax had little pain and required no treatment.

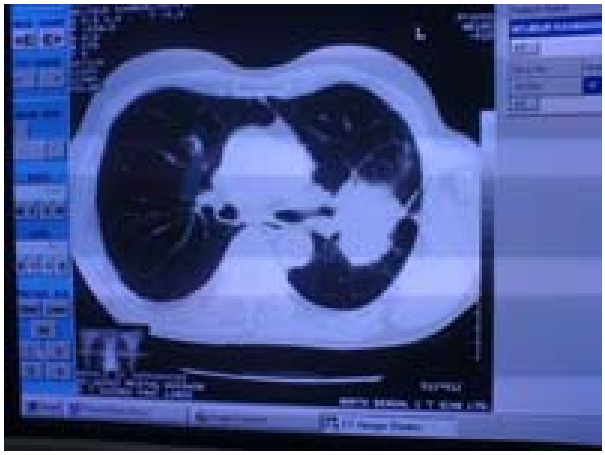

Figure 3: Axial CT showing FNAC needle into a lobulated lesion in left lobe underlying the scapula-not approachable by USG.

The definite diagnosis of malignant thoracic lesions was made by therapeutic response, a subsequent clinical course showing progressive disease and/or metastatic disease that were consistent with cancer. By same diagnosis made elsewhere in the body, from histopathological analysis of core needle biopsy specimen or surgical specimen. Though only in a very few cases thoracotomy and histopathology was done. The definite diagnosis of benign thoracic lesions was based on subsequent disappearance of the lesion or decreases in its size or follows up chest radiography showing that the lesion remained stable for at least two years.

Results

Of the 127 patients with pulmonary nodules, 93 were male and 34 were female in the age group 28–78 yrs (mean age 43.6 yrs.). 93 patients had a single thoracic lesion and 34 had multiple thoracic lesions that were located bilaterally in 5 patients and within one pulmonary lobe in 29. The distance of the lesion from the pleura ranged from 1.8 cm. to 12.9 cm (mean 4.6 cm.). Ultrasound guided FNAC was possible in 106 (83.5%) patients. Only in 21 (16.5%) patients a CT-guided mode was necessary. 127 lesions were sampled for biopsy in the 127 patients. All the patient protec with a sigl. Among the 127 lesions, 98 (%) were Pulmonary, 11(%) were mediastinal, 9 (14.2%) were hilar, 9 (7%) were pleural lesions. The mean lesion diameter was 4.8 cm. ranging from 2.4 to 12 cm.

The cytodiagnosis was made in 119 out of 127 patients. In 6 no final diagnosis could be reached because hemorrhage into the lesion obscured the main lesion. 2 patients denied to have a second needle pass. Of the 119 patients, 91 patients had malignant disease and 28 had benign disease. Prevalence rate of malignancy was 72.3 %.The statistical analysis wander in 101 definitely diagnosed lung masses. Others were lost to surveillance. The sensitivity and specificity for a diagnosis of malignancy was 91.2% and 100 %

respectively and for benignity was 68 % and 100% respectively.

Post biopsy mild to moderate pneumothorax developed in only in 9 (7.1%) cases and subsided with conservative treatment. Most of the Pneumothorax occurred in deeper lesions. One patient died within few hours of FNAB; he was terminally ill at the time of biopsy. 22 cases developed post biopsy hemoptysis and the estimated blood volume was less than 30 ml. in each. The hemoptysis stopped spontaneously without specific treatment and there was no hemodynamic or respiratory compromise.

Table I: Spectrum of benign and malignant cytodiagnosis

DIAGNOSIS		No of cases
Malignant (n-91)	Primary adenocarcinoma	24
76-by USG guidance	Undifferentiated carcinoma	1
15-by CT guidance	Small cell carcinoma	9
	Large cell carcinoma	32
	Squamous cell carcinoma	11
	Metastatic tumour	7
	Lymphoma	5
	Germ cell tumour	2
Benign (n-28)	Tuberculosis	11
22-by USG guidance	Pneumonia	7
6 - by CT guidance	Hamartoma	1
	Nonspecific inflammatory lesion	9

Table II: Sensitivity and accuracy of 119 cases where a conclusive cytodiagnosis was made

Mode of FNAB	No of patients	No of true positives	No of true negatives	No. of false positives	No. of False negatives	Sensitivity	Accuracy
USG-guided	98	77	15	0	6	92.7 %	93.8 %
CT-Guided	21	18	2	0	1	94.7 %	95.2 %

Table III: Complication rates in relation with lesion size, distance from pleura and mode of image

Different parameters	No of cases	Pneumothorax	Haemorrhage	Hemoptysis	
Mode of FNAB	USG-guided	106	7(6.6 %)	3 (2.8 %)	4 (3.8 %)
	CT-guided	21	2 (9.5 %)	2 (9.5 %)	2 (9.5 %)
Lesion diameter (cm.)	1.8-2.9	31	1 (3.2%)	3 (9.7 %)	0(0 %)
	3-12	96	8 (8.3 %)	2 (2.1 %)	6(6.3 %)
Distance from pleura	Subpleural	74	1 (1.4 %)	1 (1.4 %)	1(1.4%)
	Deep	53	8 (15.1 %)	4 (7.5 %)	5(9.4%)

Table IV: Summery of results of reported series

References	No of cases	Diagnostic accuracy	Complications		
			Pneumothorax	Haemorrhage	Hemoptysis
Stanley et al. 1988[12]	458	96.6 %	133 (29 %)	-	5 (1.1 %)
Vansonnenbergetal 1988[4]	150	82.7 %	64 (42.7 %)	-	25 (3.3 %)
Haramati et al 1995 [13]	32	81 %	3 (9.4 %)	-	-
Santambrogioetal 1997 [14]	110	81 %	23 (20.9 %)	-	-
Gouliamos et al 2000 [15]	64	98.4 %	2 (3.1 %)	1(1.6%)	-
Mohammad et al 2001 [16]	184	97 %	2(1.1 %)	-	10 (5.4 %)

Gupta et al 2002 [17]	37	91 %	1 (2.7 %)	1(2.7%)	-
J P Sing et al. 2004 [18]	34	85.3 %	4 (11.8 %)	4(11.8%)	1(2.9 %)
Present series	119	93.7 %	9 (7.6%	6(5%)	6 (5%)

Discussion

There is wide variation in reported diagnostic accuracies of FNAB between different institutions, ranging from 64% to 97%.[19] Having a cytopathologist present during biopsy and immediate evaluation of specimen adequacy have been advocated to reduce the false negative rate leading to high diagnostic accuracy[20,21]. In the present series 127 cases of thoracic masses were subjected to USG or CT-guided FNAB. In 106 cases of USG-guided ENABs conclusive cytodiagnosis was made in 98 cases resulting in diagnostic accuracy 0f 93.8 %(Table. II) With procedure adopted in this series, (6 failed out of 125).95.2% sample adequacy was obtained requiring a mean of 1.2 aspirates.

In 21 CT guided cases cytodiagnosis was made in all the patients resulting in a diagnostic accuracy of 95.2 %.(Table II) so, there was no significant difference in diagnostic accuracy in both the cases. The false negative results for malignancy may be due to a variety of factors including the patient's inability to cooperate, overlying bone which may contribute to missing the lesion completely, obtaining only necrotic tissue, or sampling pneumonitis distal to an obstructing lesion[22].

Complications, such as Pneumothorax or hemoptysis were noted in larger lesions and in deeply located lesions. Hence in this series depth of the lesion and the lesion size was directly related to the prevalence of pneumothorax and hemoptysis. Whereas, hemorrhage inside the lesion was noted mostly in smaller and deeper lesions. (Table V). These findings are also observed by other authors[23, 13].

Regarding cytodiagnosis, on an average the benign lesions were smaller in size than the malignant ones. Necrosis within the lesion was seen largely in cases of metastatic lesions, tuberculosis and in cases of squamous cell carcinoma.

Irregular margin was seen in some benign lesions including tuberculosis and pneumonia. Rib erosion and mediastinal invasion was seen in malignant lesions.

No statistically significant difference was seen between the two image guidance methods. Several authors have demonstrated that, US can be as effective as CT for guidance of thoracic biopsy of peripheral thoracic lesions[24,25,26]. CT guidance was necessary only in cases of deeper or smaller nodules, or where the nodules were located near the heart and great vessels. Most of the lesions small or large were seen abutting to the chest wall and were well visualized by USG. Hence an USG guided method was sufficient in most of the cases.

US has a number of advantages over CT including bedside approach, lower cost, and no radiation exposure which led to our preference to perform US-guided biopsy of peripheral lesions with real time monitoring. Real time monitoring itself helped avoid puncturing the aerated lung and the fact that many of the lesions were located peripherally also may have contributed to the lower rate of pneumothorax among our patients.

We therefore conclude that, image guided FNAB of pulmonary nodules allow an early diagnosis which provide improved opportunity for the cure or expeditious treatment. Transthoracic FNAB using a 20 gauge needle is a highly specific and sensitive technique with a good diagnostic accuracy and can be used safely as an outdoor procedure. Most of the cases came to the doctor with symptomatic chest diseases in which a pulmonary nodule is seen by chest X-ray, a diagnosis can be achieved by a more cost effective USG guidance method. Ultrasound-guided FNAB is a quick cheap ionizing radiation-free procedure and may be a valid option in the diagnosis of peripheral lesions. Real-time US visualization allows accurate needle placement, shorter procedure time, and performance in debilitated and less cooperative patients. Only in few cases computed tomography allows the

performance of FNAB in situations in which ultrasound do not correctly visualize the lesion or the needle tract.

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