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Computed Tomography (CT) Guided Fine Needle Aspiration Biopsy of Mediastinal and Pulmonary Masses-using A Team Approach

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SUMMARY

Ten patients with mediastinal and pulmonary masses underwent computed tomography (CT) guided. Fine needle aspiration biopsy (FNAB) in close cooperation with the cytopathologist as an alternative to diagnostic thoracotomy. Cytopathologist was in attendance in the radiology department at the time of biopsy to provide preliminary assessment and this guided us as to whether or not additional samples were needed. Adequate specimens were obtained in all patients for a cytological diagnosis and showed that 5 lesions were malignant and 5 were benign. There were no major complications and operative biopsy was avoided.

INTRODUCTION

Percutaneous Fine needle aspiration biopsy using radiologi-cal guidance has become quite common over the past many years following the work of Dahlgren and Nordenstorm[1]. These procedures are now accepted as the primary methods of diagnosis. The armamentarium used to guide these procedures are Fluoroscopy, ultrasound and CT. Fluoroscopy is inexpensive and is readily available but has poor contrast resolution, shows the structures in two dimensions and has limited applications. Ultrasound is cost effective and non invasive but has its limitations. Only those mediastinal/pulmonary masses are visualized which are in contact with the chest wall. CT offers accurate and precise localization of lesions for biopsy. It shows the relationship of the lesion with the surrounding vital structures and allows precise planning of the percutaneous access route[2].

PATIENTS AND METHODS

CT guided FNAB of mediastinal and pulmonary masses was performed in 10 patients from February 1994 to December 1995 at the Shaikh Zayed Postgraduate Medical Institute, Lahore. The ages of the patients ranged from 22 to 74 years (average 49 years). In all patients PA and lateral chest radiographs and CT Thorax were obtained as a part of routine workup to localize the mass. A prebiopsy coagulation profile was obtained in all cases. The mass was evaluated for its location, its relation to the major vessels and for any evidence of necrosis or cystic component. Optimal position and level of biopsy was determined. All biopsies were performed with CT Scanner (Technicare 2060) guidance. At the time of biopsy the patient was made to lie supine or prone depending on whether the lesion was in anterior or posterior location respectively. The patient was scanned at the appropriate level. The site of the needle entry was selected by placing a metal marker on the skin with the help of laser localizing light available on our CT scanner. The scan was repeated to confirm the location of the marker. The distance to the lesion was noted and the angle of the entry was decided. Ideally the shortest vertical approach from skin to the lesion was chosen. After skin preparation and injection of local anaesthetic, the needle (23G) was advanced to the

correct depth. During the procedure the patient was asked to suspend respiration in the same phase as used for scanning. When the needle was in place, a scan was obtained to confirm the location of the needle tip. Once the needle tip was documented to be in position, negative pressure over the attached syringe while advancing the needle was sufficient to obtain the material[2]. Cytopathologist was available in the radiology department to provide preliminary assessment and this guided the decision to whether or not additional samples were needed[3]. Adequate specimens were obtained with a single needle puncture in all cases. After the procedure, the patients were under observation for 4 hours and chest radiograph was obtained to exclude pneumothorax. Patients were instructed to lie on the puncture site if possible, in an attempt to decrease the risk of pneumothorax. Smears were made from the aspirated material and were both air dried and wet fixed in absolute alcohol. Air dried smears were stained with Giemsa stain and fixed smears were stained with Papanicolaou stain. Any material left in the syringe was allowed to clot, fixed in 10% formalin, processed as histological clot section, embedded in paraffin wax and sections were stained with routine H&E stain. All material was carefully examined and final report was issued after examination of both the smears and clot, where available.

RESULTS

CT guided Fine needle aspiration biopsies were performed in 10 patients with a radiological diagnosis of mediastinal and pulmonary masses. These included 4 mediastinal (1 anterior mediastinal, 2 middle mediastinal and 1 posterior mediastinal) and 6 pulmonary masses. These masses ranged in size from 1.5 to 8 cm (average 4.8 cm) in transverse diameter (Table 1).

Adequate tissue for cytological diagnosis were obtained in all patients and showed that 5 lesions were malignant and 5 were benign. Out of five benign lesions, two cases were of non-specific chronic inflammation of lungs, one was granulomatous lymphadenitis with epithelioid granulomas (Fig. 2d), one in addition to features of granulomatous lymphadenitis also revealed acid-fast bacilli on Z.N staining and was diagnosed as tuberculous lymphadenitis while clinical suspicision in this case was of lymphoma. The fifth benign case was of a retrosternal goitre with many clusters and groups of benign thyroid follicle cells with colloid as seen both in smears and clot (Fig. 1a, 1b). Out of five

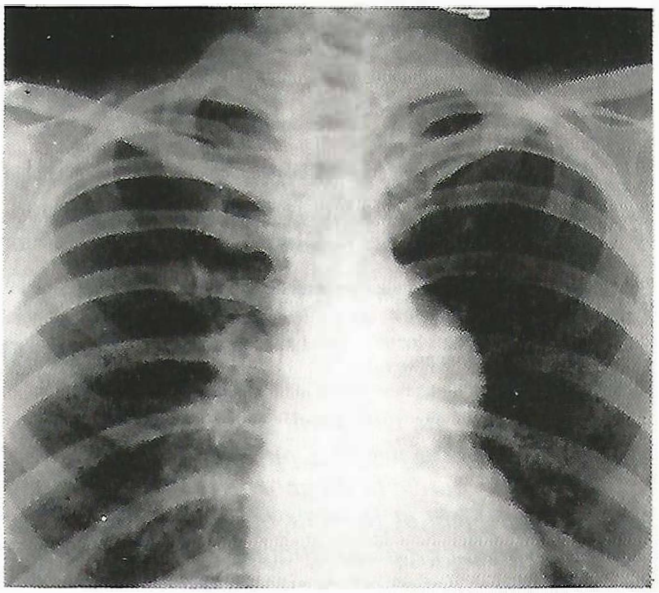

Fig. 1a. PA Chest radiograph shows a mediastinal mass projecting to the left of aortic arch and main pulmonary artery.

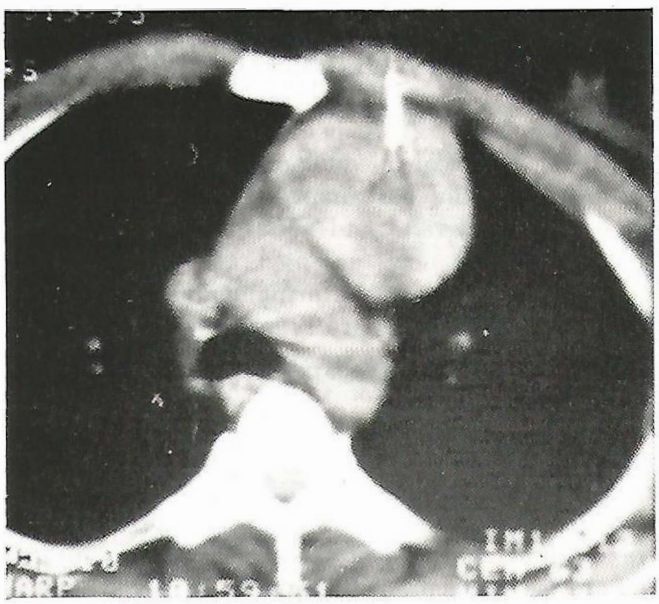

Fig. 1b. CT shows the position of the aspiration needle within the anterior mediastinal mass.

malignant cases three were squamous cell carcinomas with malignant squamous cells seen in smears and clot (Fig. 2a,b), one was an undifferentiated carcinoma of the lung, OAT cell type (Fig. 2c) and the fifth case was of high grade

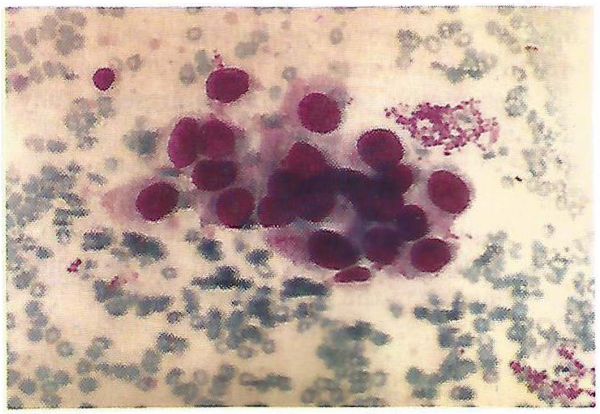

Fig. 2a. FNA, smear - malignant squamous epithelial cells.

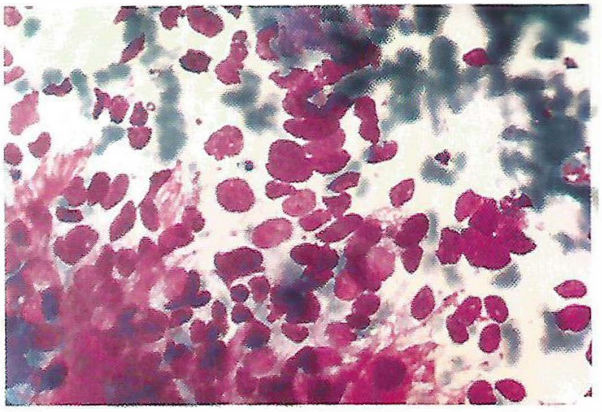

Fig. 2c. FNA, smear - OAT cell carcinoma.

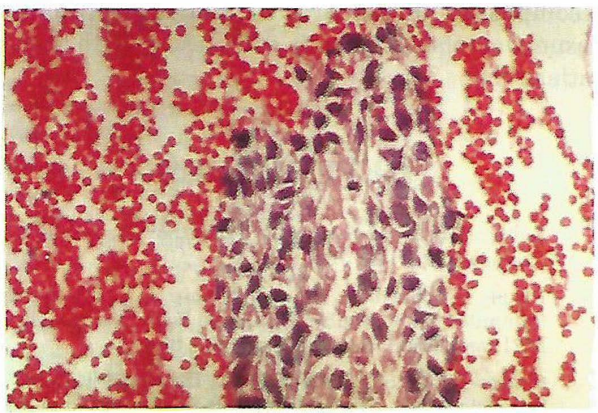

Fig. 2b. FNA, clot - squamous cell carcinoma.

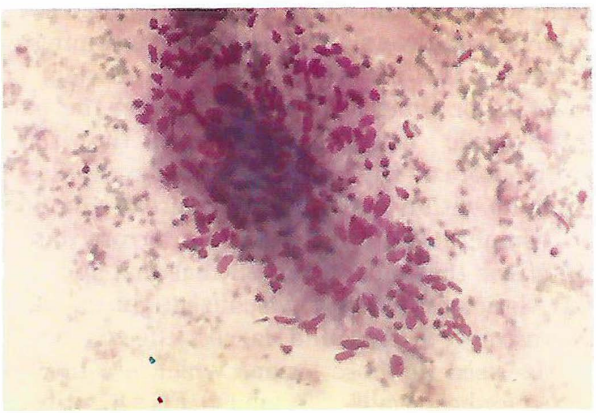

Fig. 2d. FNA, smear - epithelioid cells and lymphocytes.

non-Hodgkin's Lymphoma involving the mediastinal lymph nodes. In addition to the cell morphology as seen in smears, the histological sections from the clot prepatations were found to be very useful in final diagnosis of these lesions. Four patients sustained minimal pneumothorax but no one required a chest tube. No other complications were encountered.

DISCUSSION

There are numerous reports in the literature on percutaneous fine needle aspiration biopsy of intrathoracic lesions using Fluoroscopy, Ultrasound and CT for guidance[1-7]. Single-plane Fluoroscopy is readily available, inexpensive but has poor contrast

Table 1: Patient data.

Location of lesion	*Case*	*Age (yrs)*	*Sex*	*Size (cm)*	*Cytopathology*
Pulmonary	1	74	M	5.0	Squamous cell Carcinoma
	2	47	F	1.5	Chronic inflammation
	3	70	M	4.0	Squamous cell Carcinoma
	4	50	M	3.5	Chronic Inflammation
	5	35	M	7.0	Squamous cell Carcinoma
	6	40	M	4.5	Undifferentiated Carcinoma
Mediastinal Middle	7	22	M	2.5	Granulomatous Lymphadenitis
Posterior	8	62	F	6.0	Tuberculosis
Middle	9	60	M	6.0	Non Hodgkin's lymphoma
Anterior	10	27	F	8.0	Intrathoracic Goitre

resolution. Assurance that one is sampling the lesion requires maneuvers that are time consuming such as turning the patient into lateral position, cross table film or contrast injection. Moving the patient with needle in place increases the risk of pneumothorax. Biplane Fluoroscopy verifies the needle tip within the lesion and therefore minimizes the complications and sampling errors but has limitations that most of the mediastinal and central hilar lesions are not visualized during lateral Fluoroscopy[8]. Ultrasound is cost-effective but can only be used in those lesions which are in contact with the chest wall[9]. CT guided FNAB, utilizing a team approach is the method of choice in the diagnosis of mediastinal and pulmonary lesions in which a diagnosis could not be reached through non-invasive methods such as sputum cytology and bronchoscopic biopsy[3,10]. This protocol has a twofold goal (a) reducing patient risk and (b) minimizing sampling error. The major cardiovascular structures close to a lesion appear to be at a considerable risk of being injured. CT is the best method of demonstrating these structures and eliminating the risk of puncturing them during the procedure. There are two potential sources of error in needle biopsy procedures (i) mishandling of the specimen or inadequate interpretation (ii) sampling error (8). Of these the first was overcome by the presence of a trained cytopathologist in the CT suite who prepared slides and ensured adequate and representative sampling. The second can be the result of either failure to obtain tissue from the lesion or sampling a non representative portion. In the present study the risk was minimized through the use of CT that provided precise localization of the lesion and defined the exact location of the needle tip within the lesion. Aspiration of central necrosis can also account for the sampling error and can be avoided by repeat sampling of the peripheral capsule.

CONCLUSION

The greatest advantage of CT as a guide for transthoracic interventional procedure is its ability to define the exact location of the needle tip within a lesion. This allows masses to be aspirated with high degree of accuracy and less risk of complications. The primary objective of FNAB is to distinguish malignant from benign lesions and to improve the reliability of a negative FNAB. This was accomplished in the present study. Representative tissue was obtained from each lesion with minimal patient risk.

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