

Diagnostic Value of Transthoracic Fine Needle Aspiration Biopsy in Thoracic Lesions

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Abstract

Transthoracic fine needle aspiration biopsy (TFNAB) is a frequently used method that has low complication rate. In this study, we investigated the accuracy and complication rate of TFNAB which we have performed in 102 patients with negative sputum cytology and negative bronchoscopic examinations for the thoracic mass lesions.

Of these patients hospitalized in our hospital between March 1995 and December 1997, 86 of them were male, 16 of them were female, and their mean age was 50 ± 6.5 years. The same process was performed in 15 patients for two times, and in 5 patients for three times. Totally 127 procedures were performed; 55 by computerized tomography, 45 by ultrasonography, and 27 by fluoroscopy.

In 60 of the total 102, malignancy and in 39 of them cytologic findings suggesting benignity were obtained. In three cases, sufficient diagnostic specimen could not be obtained. Of the 102

cases, malignancy in 67, and benignity in 35 were confirmed by histological, microbiological, clinical and/or radiological follow-up. In the 4 of the 6 cases that were diagnosed as benign by TFNAB, surgical, and in 2 of them clinical and radiological diagnosis were made; these 6 cases and one with insufficient specimen were considered as false negative cases. While the diagnostic value of the process in all the thoracic lesions was found as 70.58%, in malignant lesions the sensitivity was 89.55%, specificity was 100% and accuracy was 91%. The diagnostic value in benign lesions was low. Specific diagnosis could be established in only 12 (34%) of the benign lesions. The most frequent complication was pneumothorax and was seen in 10 cases (9.8%), and chest tube was needed in only 4 of them. Other complications were hemoptysis in 9 cases and hemorrhage in one. We concluded that TFNAB is a safe and easily applied method especially valuable in the diagnosis of malignant lesions.

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Introduction

Transthoracic fine needle aspiration biopsy (TFNAB) was applied for the first time by Leyden in 1883 for exposing the microorganism that is active in pneumonia. In 1886 Menetrier also used this method for the first time to diagnose lung cancer. It was possible to reach peripheral, hilar and mediastinal lesions which are hard to be recognized by bronchoscopy in cases that can not be diagnosed by other noninvasive procedures. TFNAB is a method that can be applied by the guidance of ultrasonography (US), scopy and computerized tomography (CT) and allows fast diagnosis. It is cheap, can be repeated and the complication rate is low. However, the biggest disadvan-

tage is that an experienced cytologist is needed for diagnosis (1,2,3).

In this study, we investigated the sensitivity and complications of TFNAB in malignant and benign thoracic lesions in 102 patients undiagnosed by other methods.

Materials and Methods

The diameter and localization of each thoracic lesion was not taken into consideration. Before biopsy, the clotting time of every patient was measured, and pulmonary function tests were performed. Patients gave their informed consents.

3.5 MHz elliptical probe was preferred in ultrasonography.

Each patient was given a position on the bed, appropriate with the localization of the lesion, and the biopsy area was marked. Skin disinfection was performed. Anesthesia of skin and subcutaneous tissues was done by the local anesthetic. 18-22 gauge Chiba needles were used in aspiration process. After choosing the appropriate needle for the patient and the lesion, the needle was inserted toward the pleura in an angle determined by the guiding method. While we were passing through pleura, the patient was asked to hold his breath and the needle was inserted into the lesion. After it was confirmed that the needle was in the lesion, aspiration was applied by a 50 cc syringe. During the aspiration, in order to increase the quality of the specimen, the needle was moved back and forth and rotated around itself.

The specimen was taken and smeared on the microscope slide and sent for pathologic examination in 95% alcohol. This process was repeated and performed in each patient at the most three times when the specimen was found insufficient.

In the first and 24th hour after the procedure, chest x-rays were taken and the patient was followed regarding possible complications.

Results

In this study, we have included 102 patients with thoracic mass lesions who were hospitalized and examined in our hospital between March 1995-December 1997. The results of sputum cytology and bronchoscopic examinations of all the patients were negative. Eighty-six of the patients were male, and 16 of them were female. The mean age was 50±6.5 years. The same procedure was performed in 15 patients for two times, and in 5 for three times. A total of 127 TFNAB procedures were performed: 55 by computerized tomography, 45 by ultrasonography and 27 by fluoroscopy.

TFNAB specimens were positive for lung cancer in 60 (Table 1) and for specific benign diagnoses in 12 of 102 cases, whereas they were nondiagnostic in the remaining 30.

Cell Type	Number (%) of Cases
Undifferentiated CA	20 (33.3)
Squamous Cell CA	18 (30.0)
Adeno CA	11 (18.3)
Small Cell CA	7 (1.6)
Large Cell CA	3 (5)
Atypical Carcinoid	1 (1.6)
Total	60 (100)

CA: Carcinoma, TFNAB: Transthoracic fine needle aspiration biopsy

By histological, microbiological, clinical and/or radiological follow-up, of 102 cases, eventually 67 cases were definitely diagnosed with malignant disease, and 35 with benign disease (Figure 1)

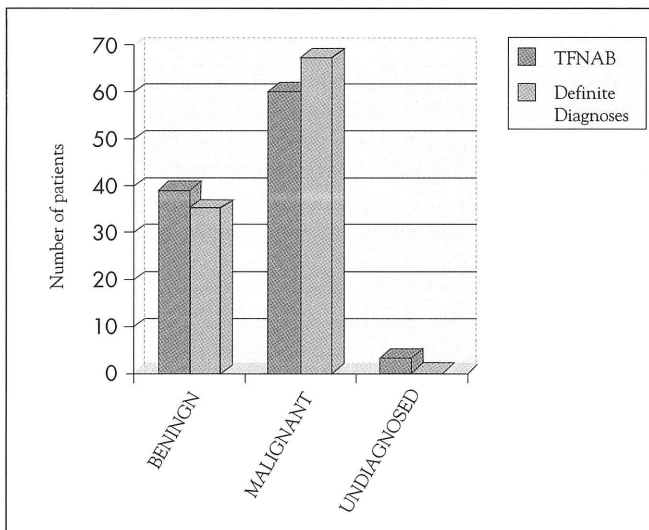


Figure 1: Diagnostic yield of transthoracic fine needle aspiration (Figure 1)

By TFNAB, the final diagnoses of 6 cases, (which were said to be cytologically benign before) and one case from which we could not obtain sufficient specimen, were malignant. Four of these 6 cases were surgically, and 2 were clinically and radiologically diagnosed as malignant. These 6 cases and one case with insufficient specimen were accepted as false negative (7 false negatives).

The diagnoses of benignity were made in 6 cases by thoracotomy, in 7 cases by video-assisted thoracoscopic surgery, in 12 cases by cutting needle biopsy and in 10 cases by microbiological and clinical follow-up. In 12 of the 35 cases

Table 2. Cases with definite benign diagnosis

Diagnose	No (%) of Cases
Tuberculosis	13 (37.1)
Pneumonia	10 (28.5)
Hydatid Cyst	3 (8.5)
Lung Abscess	2 (5.7)
Fibrous Tissue	2 (5.7)
Benign Epithelial Tissue	2 (5.7)
Cystic Fibrosis	1 (2.8)
Pneumoconiosis	1 (2.8)
Loculated Empyema	1 (2.8)
Total	35 (100)

definitely diagnosed with specific benign disease, 8 were pneumonia, 2 were tuberculosis, one had lung abscess and another had hydatid cyst (Table 2).

Two of the three cases which we got insufficient specimen, were diagnosed as hydatid cyst and chorioepithelioma by thoracotomy, and one was diagnosed as chronic interstitial pneumonia by video-assisted thoracoscopic surgery.

While the diagnostic value of TFNAB in all the thoracic lesions was found as 70.58%, in malignant lesions its sensitivity was 89.55%, specificity and positive predictive value was 100%, negative predictive value was 63% and accuracy was 91%. Its sensitivity was low in benign lesions (34%).

The most frequent complication due to the procedure was pneumothorax, developed in 10 cases (9.8%). Only in four of these 10 cases, chest tube was needed. Other complications were hemoptysis in 9 cases (8.8%) and hemorrhage in 1 case (0.9%).

Discussion

In thoracic lesions, early diagnosis, separation of malignant-benign lesions and early medical treatment are the main goals to decrease mortality. Sorting out primary pulmonary neoplasm of the lung is important regarding the therapeutic decisions and prognosis. Thus, a differential diagnosis is compulsory in pulmonary lesions developing in cases with primary extrapulmonary neoplasm (4).

However in some patients both the sputum cytology and bronchoscopic studies may be insufficient to make a diagnosis. TFNAB is a valuable method that can be used when sputum is unavailable, or the location of the lesion or clinical status of the patient is not suitable for bronchoscopic procedures. Compared with thoracotomy and open lung biopsy, it is a cheaper and an easier method and has a fairly low mortality rate (1,2).

TFNAB which has been used approximately for hundred years, has become a valuable diagnostic tool today by means of the improvements in guiding methods and cytopathologic evaluations (5,6).

It does not require general anesthesia, is safe and can be repeated as needed. It provides results in a short period and can be applied on an outpatient basis and can be performed even in the patients under high risk (e.g. heart diseases). All these are the advantages of TFNAB (7,8,9). TFNAB has few contraindications as hemorrhagic diathesis, bullous emphysema, pulmonary hypertension and a high rank of vascular tumors (7,8).

Biopsies are performed under fluoroscopy, ultrasonography and computerized tomography. The diameter of the needle used varies between 16 and 23 gauge. To obtain a correct result, a guiding method appropriate for the location of lesion should be chosen. Ultrasonography shows the localization of the lesion well when it is in relation with pleura and removes pneumothorax risk on a large scale by determining the maximum distance the needle should take inside the lesion (10,11).

By the use of fine needles under the guidance of computerized tomography, deep lesions of the lung can be reached and complications can be reduced (12,13).

TFNAB should be done with a needle of appropriate gauge, and the process should be repeated according to the result given by an onsite experienced cytologist. The negative TFNAB specimen decreases the possibility of malignancy, but does not prove to be definitely benign (14). The false negativism of TFNAB is mostly due to the insufficiency of the specimen obtained from the lesion. Sufficient specimen cannot be obtained due to necrosis or fibrosis. Secondary pneumonia and inflammatory reaction exist around malignant nodules. The resistance it forms can lead to the incapability of getting accurate specimen by giving a misleading sense of the needle that it was in the lesion though it is not (15). The experience of the physician executing the process is important. Furthermore, the existence of a cytopathologist during TFNAB increases the rate of diagnosis on a large scale (16).

The consistency between the cytology obtained by TFNAB and the control results obtained by the histological examinations vary approximately between 60 and 97%. It is hard to distinguish squamous cells, large cells and adenocarcinoma from each other by the use of TFNAB, but the differentiation of these three subtypes do not affect the treatment. The most important point is to differentiate the small-cell from nonsmall-cell lung carcinoma, and this can be done by TFNAB (5,15,17-19).

In various literatures it is recorded that in the diagnosis of lung cancer, the sensitivity of TFNAB technique is 80-95%, and the specificity is 95-100%. In our study, the sensitivity was found to be 89.55%, the specificity 100% and the accuracy 91% in malignant lesions, which is concordant with the related literature (20-26). In determining benign disease, accuracy rates varying between 1% and 91% are reported (23-26). The rate of diagnosis in benignity was also low in our study. The common opinion is that sufficient specimen cannot always be obtained by TFNAB in diagnosing benign cases. TFNAB method is competent for cytology and microbiological examination, but insufficient for histological examination (27).

Goranik et al., proposed that selection of the needle should be done according to the location of the lesion, and aspiration biopsy is sufficient in many cases by the first procedure. They recommended the cutting needle biopsy in lesions that are thought to be benign (25). Pang et al., declared better results with trucut biopsy compared with TFNAB in the lesions which are thought to be benign (28).

Bilgiç et al., compared TFNAB with cutting needle biopsy and noted that sensitivity of TFNAB in benign lesions is low. They ascribed this to the insufficiency of the specimen. The success rate in benign lesions is reported to be between 31% and 52% (9).

There are some publications that do not recommend TFNAB in lymphoma, thymoma or in lesions thought to be benign (24).

Turgut et al., investigated the diagnostic value of TFNAB in Pancoast tumors under ultrasonographic guidance and reported a sensitivity of 94.28% and a specificity of 100%. Their complication rate is concordant with that in our study and with the rates reported in pertinent literature (29).

The most common complication of TFNAB is pneumothorax (30). In the present study, the most common complication developed was also pneumothorax (9.8%), where in these cases we had to repeat the procedure and pass more tissues anatomically. Only in 4 of them, chest tube was needed. During the process, the risk of pneumothorax depends on some factors like the age of the patient, the size, depth and localization of the lesion, the diameter of the needle used, the number of passes into the lung and the cooperation of the patient (26,31,32). It is declared that pulmonary function tests do not affect the pneumothorax rate (33). The rate of pneumothorax is reported to be between 5% and 10% in the literature (1,34). Hemoptysis,

which is experienced rarely has a rate between 3% and 10%, and is usually minimal (34,35). There is a rare possibility of the implantation of tumor cells. However, metastasis implantation is very rare when fine needles are used (35,37). Implantation of malignant cells onto the route of the needle was experienced only in one of the patients in Sinner's series of 5300 cases (26).

Mortality due to TFNAB reported in the related literature was encountered because of intrapulmonary hemorrhage, air embolism and pneumothorax which were not treated (38,39). In our study, these serious complications were not seen. Only in one case, we had hemorrhage that was not serious.

In conclusion, TFNAB is a valuable, easily performed and well-tolerated method with high diagnostic accuracy and low complication rate, and thus, obviates more invasive diagnostic procedures.

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A view from Venice; Photographed by Sait Karakart, MD