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Thoracic CT-Guided Needle Biopsy: A Report of 150 Cases

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ABSTRACT

Background: *The purpose of this study is how to use CT-guided needle biopsy for the diagnosis of pulmonary, pleural, and mediastinal mass lesions. Meanwhile, the complications of the procedure were evaluated.*

Materials and Methods: *The pathology results of 150 biopsy specimens, which were obtained from 145 patients aged from 9 to 87 years old (55.3±17.6) referred during a one-year period were reviewed, and the frequency of pneumothorax and hemoptysis were analyzed.*

Results: *Lesion size ranged 1-18 cm [mean (±SD) 6.5±3.4 cm]. 95 lesions were contacted to the chest wall. Pathological studies showed that 22 specimens were benign, 61 malignant, 28 nonspecific, 17 suspicious for malignancy, and 22 insufficient for diagnosis. Risk for pneumothorax and hemoptysis was 6 and 2 percent respectively, which were much better results than previous reports.*

Conclusion: *Although our low complication rate may be attributed to the large size of the lesions and their small distance from the chest wall, we still recommend CT-guided needle biopsy as a useful diagnostic method for thoracic mass lesions.* ***(Tanaffos 2002; 1(3): 51-55)***

Key Words: *CT- guided biopsy, complication, Needle biopsy*

INTRODUCTION

CT-guided transthoracic needle biopsy of the lung has been shown to be a relatively safe and accurate method for establishing the diagnosis of benign and malignant lesions of the chest (1).

There have been some reports on complications of the procedure; some of which such as systemic air embolism, pericardial tamponade, and seeding of malignant cells are rare but may be fatal; the others, such as pneumothorax have been more frequent(2,3,4).

The reported frequency of biopsy-associated pneumothorax ranges widely from 5% to 61% (5,6,7,8). The frequency of complications appears to be higher for CT guidance (comparing with fluroscopically-guided biopsy), possibly because more difficult lesions are attempted, the procedure

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gets longer, and more pleural passes may be required (1,9).

This report summarized our experience with 150 consecutive CT-guided transthoracic needle aspiration biopsies over an eighteen-month period.

Meanwhile, attempts were achieved to decrease the pneumothorax rate by using a small-gauge needle and eliminating the number of pleural passes.

MATERIALS AND METHODS

Between June 1998 and January 2000, one hundred-fifty consecutive percutaneous fine needle aspiration biopsies were performed in our institution. The cases were patients in whom thoracic lesions were observed in chest radiographs, but no specific diagnosis was made after sputum culture; sputum and pleural fluid cytology; and bronchoscopy. Meanwhile, those who were not considered as suitable candidates for surgery, bronchoscopy, mediastinoscopy or thoracoscopy following the sputum and pleural fluid tests entered our study. The study population included 93 men and 57 women with a mean age of 55.3 years old (range, 9-87 years). Level of needle entry site, lesion location (pulmonary, mediastinal or pleural) and lesion depth were determined in each case by reviewing preliminary scans obtained by Siemens Somatom Plus CT scanner (Frankfurt, Germany).

To minimize the number of pleural crossed surfaces, the patients were positioned to make the most proximal surface of the lesion accessible.

Local anesthesia with 2% lidocaine was administered subcutaneously. All biopsies were performed using a 13.97cm 20-gauge Westcott needle (Becton Dickenson & Co., Rutherford, New Jersey) while the patient hold their breath by positioning the needle into the most accessible aspect of the lesion. Core biopsy specimens were submitted in 10% formalin, and aspiration specimens were spread on a slide for pathologic studies. Frozen section or cytopathologic analysis was not available during the biopsy although all tissue samples were sent for pathologic reports immediately after biopsy. All the biopsies were performed by one radiologist.

Follow up CT-scans were obtained in all the patients immediately after biopsy and 4 hours later to evaluate the pneumothorax. In case of pneumothorax, the surgery department was consulted, and chest tube was placed if it deemed necessary. During management, there was no preference in assigning the patient either to the puncture-site-dependent or the puncture-site-nondependent recumbent positions. In case of hemoptysis, after surgery consultation, the patient was assigned to the puncture-site-dependent recumbent position to prevent expansion of hemorrhage to the contralateral lung and eventual aspiration.

Biopsies were repeated after one week in five compliant patients after pathology analysis revealed that the specimens were insufficient.

RESULTS

In 128 cases (85%), biopsy yielded sufficient tissue for pathologic studies, among them; 22 lesions were benign, 61 were malignant, 28 were categorized as "nonspecific", and 17 were suspicious for malignancy. In 22 cases, the obtained specimens were insufficient for a definite diagnosis. The locations of the lesions are shown in Table1.

Table 1. Location of lesions

Anatomy	Number of Lesions
RUL	27
RML	17
RLL	28
LUL	25
Lingula	10
LLL	19
Hillus	3
Mediastinum	10
Pleura	9

Complications occurred in 12 cases (8%), including 9(6%) pneumothoraces and 3(2%) cases of hemoptysis. Considering the pneumothorax, all patients had lung lesions.

Considering the distance of lesions from the chest wall, 55(26%) had at least 0.5cm distance (range 0.5-4.5 cm), whereas, the remaining 95(74%) were contacted to the chest wall (0 cm distance). The mean lesion size (±SD) was 6.5±3.4 cm, ranged from 1 to18 cm.

Of the 9 cases of pneumothorax, just one necessitated chest tube placement due to respiratory distress; however, the others were managed conservatively and discharged after 24 hours. A small chest tube (9F) was placed for the distressed patient, and he was discharged after 48 hours. Table2 shows the type of lesions.

Table 2. Type of disorders

Disorders	Number of Patients
Small Cell Carcinoma	5
Squamous Cell Carcinoma	19
Adenocarcinoma	13
Undifferentiated	7
PNET	2
Non-Hodgkin's Lymphoma	1
Carcinoid Tumor	1
Pancoast Tumor	1
Mesothelioma	1
Broncho-alveolar Cell Carcinoma	1
Metastasis	10
Nonspecific Inflammation	23
Necrotic Tissue	4
Squamous Metaplasia	1
Benign Disorders	22

DISCUSSION

As the study performed by Collings et al., showed that the puncture-site-down post-biopsy position affecting neither the incidence of post-biopsy pneumothorax nor the incidence of pneumothorax requiring chest tube placement in case of pneumothorax, we had no preference in assigning the patients to either of the aforementioned positions (14). However, in the case of hemoptysis, the patients were assigned to the puncture-site–dependent recumbent position to prevent the contralateral lung from spreading hemorrhage and eventual aspiration.

Previous studies reported that CT-guided core biopsy permitted access to nearly all thoracic lesions visible on CT scan (9). Our results showed that 85% of specimens were sufficient for pathologic diagnosis, and they also confirmed the aforementioned presumption.

There has been controversy on categorizing the diagnoses of the obtained specimens. Li et al. categorized "nonspecific inflammation" as benign lesion (9); whereas, Westcott defined specific diagnoses (e.g. hamartoma, infarct, granuloma, abscess, and infectious organisms) as benign and any other apparently benign result (e.g. inflammation, necrosis and blood) as "nonspecific", due to their possibility of malignancy (10). In our cases, we found a lesion showing squamous metaplasia, and it is counted as a nonspecific lesion.

Prior investigators assessed complication rate by categorizing lesions to "small" and "large" nodules (11,12,13). In our study, the mean lesion size was 6.5±3.4cm that could be due to the late referral of cases. Meanwhile, 63% of cases had lesions adjacent to the chest wall. The large size of lesions and close proximity to the chest wall may be associated with our very low (8%) pneumothorax rate; no aerated lung was passed, and the patient was not put at risk of pneumothorax.

On the other hand, 37% of our patients had lesions not adjacent to the chest wall, but they still had a very low rate of pneumothorax, which was rarely reported in literature.

Hemoptysis is another complication which usually has no correlation with the distance of lesion from the chest wall, indeed there may be lesions with the

least distance from the chest wall but with massive hemoptysis after performing biopsy; this could be due to high vascularity or connection to bronchial vascular system. We think that in our study, low complication rate is chiefly due to the use of Westcott 20 gauge flexible needle which decreases the rate of lung injury. Obtaining pathologic specimen by using these needles was feasible due to wide rang of motion and mechanical vaccum induced by syringes connected to its end, while doing so with automated gun biopsy needle was not convenient.

Thirteen lesions were located in the hilum and mediastinum, and none of them led to any major complications, which was in accordance with previous reports (12). It may be concluded that needle aspiration biopsy is preferred in the diagnosis of hilar and mediastinal lesions.

The other important factor in reducing complications is performing the procedure by well-skilled hands, which is also taken into consideration while conducting our study.

Ultrasound guided needle biopsy is another means of performing needle biopsy, even though needle biopsy by CT guidance seems to be more beneficial. Possibly because most of the lesions located retrocostally, retrosternally, or adjacent to vertebra can not be detected by ultrasonography; besides, ultrasound is unable to evaluate the contour and size of the lesions, even if the lesion is attached to the chest wall. Furthermore, determining of complications like pneumothorax or hematoma adjacent to or inside the lesion is not completely possible.

Therefore, due to lower rate of complications, feasibility, and accessibility to lesions located in the hilar or mediastinal region, CT- guided needle biopsy is considered as the method of choice for obtaining biopsy specimen from intrathoracic lesion with the best possible outcome.

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