

## Complications in Transbronchial Lung Biopsy

Sung Ho Hue, M.D.

*Department of Internal Medicine, College of Medicine, Chung-Ang University, Seoul, Korea*

*Transbronchial lung biopsy was performed in 68 patients with various lung diseases. As an initial diagnostic procedure in diffuse and localized lung diseases, transbronchial lung biopsy offers an attractive alternative to open lung biopsy.*

*Recently improvement in the development of medical technology has greatly facilitated this technique, but it must be kept in mind that a transbronchial lung biopsy is not without complication and sometimes potentially serious complications may occur.*

*This study documents the complications of transbronchial lung biopsy with 8 cases of pneumothorax (11.8%), one case of mediastinal emphysema (1.5%), 3 cases of hemorrhage (4.4%), 2 cases of cardiac arrhythmia (2.9%), but none of them was fatal and they responded well with treatment.*

---

**Key Words:** TBLB, Diagnosis Lung Cancer

### INTRODUCTION

Since the introduction of fiberoptic bronchoscopy in 1970, its usefulness in many different situations has been documented<sup>1)</sup>.

Much more of the transbronchial tree can be visualized with the aid of the fiberscope. In addition, fiberoptic bronchoscopy is considered less traumatic to the patients and less anesthesia is required. Another important advantage of fiberoptic bronchoscopy is that it can be done on patients who are on ventilators.

Reports of transbronchial lung biopsy (TBLB) using fiberoptic bronchoscopy began to appear in 1974, about lung biopsies for diffuse pulmonary diseases<sup>2)</sup>.

TBLB allows one to obtain a small specimen of the lung with minimal morbidity, but it should be emphasized that TBLB is not always performed without complications. Although the experience of each investigator has been limited, the incidence of serious complication has been rarely seen<sup>3-5)</sup>.

This report documents the results and complications of TBLB done at the Veterans

Administration Medical Center, affiliated with University of Tennessee, in Memphis, Tennessee.

### MATERIALS AND METHODS

During the 6 months between April and September 1984, 235 cases of fiberoptic bronchoscopy were performed at the Veterans Administration Medical Center, affiliated with University of Tennessee, in Memphis, Tennessee.

In 68 of 235 cases, TBLB was performed. All patients should have an empty stomach. Three medications were administered intramuscularly 30 to 60 minutes before the bronchoscopic examination: a narcotic, an anticholinergic, and a sedative<sup>6)</sup>. Morphine (10 mg) is the preferred narcotic because of its cough suppressing, pain relieving, and euphoria producing properties. Meperidine (Demerol 100 mg) would be preferred in asthmatic patients. Atropine (0.5 mg) minimizes vasovagal reflexes and oral secretions. If a patient is asthmatic, atropine 1 mg is given to block cholinergic bronchospasm. Diazepam (Valium 10 mg) provides extrasedation as well as some protection against acute convulsive reactions to the topical agents such as lidocaine.

The most frequently used topical agents are lidocaine, cocaine, and tetracaine<sup>7,8)</sup>. Tetracaine is

---

Address reprint requests: Sung Ho Hue, M.D., Department of Internal Medicine, Chung-Ang University Hospital, Seoul 100, Korea

available in an aerosolized spray as a 2 percent solution in cetacaine, and its use is usually limited to spray the mouth and pharynx.

Cocaine, which is widely used by many physicians in the U.S.A. is believed to produce the best anesthesia. The duration of action lasts for 45 to 60 minutes and the recommended dosage is 200 mg.

Lidocaine in 2 percent and 4 percent solutions is currently the most popular agent, although it, too has definite toxicity, and its total dosage should generally be limited up to 400 mg. Its effect lasts for no more than 20 or 30 minutes.

In the pulmonary department of the University of Tennessee, 4% cocaine is therefore used for the usual patients, but in poor risk patients, only 2% lidocaine is recommended, because the effect of the drug is shorter than that of cocaine.

After topical anesthesia, the TBLB is carried out by passing the closed forceps peripherally under the fluoroscopic guidance to the area of involvement whereupon the biopsy is taken<sup>9,10</sup>.

The pre-selected segmental bronchus, through which the forceps is to be passed, is identified by the fluoroscopes and 5 ml of epinephrine (1:20,000) is injected by a bolus into this airway. Then the operator utilizes fluoroscopic control to pass the biopsy forceps to the desired area.

Routinely, four to five specimens (occasionally up to eight) are taken.

**Table 1. Age Distribution of Patients**

Age (years)	Number of patients
41 — 50	4
51 — 60	21
61 — 70	30
71 — 80	9
Over 80	1
Total	68

**Table 2. Racial Distribution of Patients**

Race	Number of patients
White	32
Black	31
Others	5
Total	68

## RESULTS

Of the 68 patients entered into this study, all of them were males with mean 62 years of age, ranging from 42 to 86 years (Table 1). The patients studied here consisted of 32 whites, 31 blacks and other races, as shown in Table 2.

Table 3 presents the smoking history of these patients. Diagnoses after the TBLB are listed in Table 4.

Non-diagnostic tissues were obtained in 13 cases (19.1%), including too small size of specimens. When results of the biopsy did not fit the clinical findings, open lung biopsy was recommended, if the patient could tolerate it.

Lung cancer was the most frequent disease diagnosed with TBLB (24 cases, 35.5%) in this study. Others included chronic interstitial pneumonitis and fibrosis, metastatic cancer, collagen disease, sarcoidosis, pneumocystis carinii

**Table 3. Smoking History of Patients**

Smoking history (pack-year)	Number of patients
0 — 10	4
11 — 20	21
21 — 30	38
Over 30	5
Total	68

**Table 4. Diagnosis with the Transbronchial Lung Biopsy**

Diagnoses	Number of patients
Non-diagnostic tissue	13 (19.1%)
Bronchogenic carcinoma	24 (35.3%)
Chronic interstitial pneumonitis and fibrosis	8 (11.8%)
Collagen disease	4 (5.9%)
Metastatic cancer	7 (10.3%)
Sarcoidosis	4 (5.9%)
Pneumocystis carinii pneumonitis	3 (4.4%)
Legionnaire's disease	1 (1.5%)
Fungal disease	2 (2.8%)
Pneumoconiosis	1 (1.5%)
Lipoid pneumonitis	1 (1.5%)
Total	68

**Table 5. Complications of Transbronchial Lung Biopsy**

Complication	Number of patients
Pneumothorax	8 (11.8%)
Mediastinal emphysema	1 ( 1.5%)
Bleeding (50 ml)	3 ( 4.4%)
Cardiac arrhythmia	2 ( 2.9%)
Total	14 (20.6%)

pneumonitis, fungal disease, legionnaire's disease, pneumoconiosis and lipid pneumonitis, in order. Comparing to our data in Korea, sarcoidosis is more frequent cause of diffuse pulmonary diseases.

Table 5 demonstrates that pneumothorax was the most common complication of TBLB (8 cases, 11.8%). A thoracic roentgenogram should be obtained immediately after the procedure and again approximately 24 hours later. Intrapleural suction was used for 24 to 48 hours in 5 cases (7.4%), and as a result of treatment, none was proven to be a serious problem.

Hemorrhage, estimated at greater than 50 ml, occurred in 3 cases (4.4%), which did not require surgery in order to control the bleeding.

There were 2 cases of cardiac arrhythmia (2.9%) with premature ventricular contractions, which were successfully controlled by the lidocaine infusion.

## DISCUSSION

TBLB has been used for the diagnosis of pulmonary nodules and diffuse lung diseases<sup>3,11,12</sup>.

In 1965, 13 cases of diffuse pulmonary disease, in which lung biopsy specimens were obtained via the rigid bronchoscope, were reported<sup>11</sup>.

In 1969, Shigeto Ikeda introduced his flexible bronchoscope at the Mayo Clinic. Soonafter, pulmonologists in the U.S. were enthusiastic about its use for general diagnostic bronchoscopic procedures. Recently TBLB has been proven to be useful in the diagnosis of many different lung disease.

Fiberoptic bronchoscopy with TBLB is helpful in the diagnosis of suspected lung cancer. In case of invisible lesions, the accuracy of diagnosis can be improved to about 70% with the combination of transbronchial biopsy and transbronchial brushing under the fluoroscopic guidance<sup>9,13,14</sup>.

TBLB is also useful in the diagnosis of metastatic neoplasms to the lung and transbronchial biopsy and transbronchial brushing are complementary<sup>15</sup>.

Another important indication of TBLB is the diagnosis of diffuse infiltrative lung diseases. Sarcoidosis and diffuse carcinomatosis are the two main diffuse infiltrative lung diseases that can be definitely diagnosed with TBLB.

The TBLB of up to 90% of patients with sarcoidosis will demonstrate non-caseating granulomas whether or not the lungs are involved radiographically<sup>16</sup>. Other causes of diffuse pulmonary infiltrates are less readily diagnosed with TBLB because the sample is so small, and an open lung biopsy is preferred in such patients when possible<sup>17</sup>.

Since the compromised hosts frequently develop acute illness with pulmonary infiltrates, the fiberoptic bronchoscopy with TBLB may be a useful procedure in these individuals. The procedure should be done as soon as possible to make the definite diagnosis of pulmonary infiltrates, if the clinical picture and sputum Gram's stain do not suggest acute bacterial pneumonia.

The main diagnosis made with TBLB in this setting are infections (particularly pneumocystis carinii) and neoplasms. If the results of TBLB shows only nonspecific inflammation, an open lung biopsy should be considered<sup>18,19</sup>.

It should be emphasized that TBLB is not always done without complications. Most fiberoptic bronchoscopies are done with sedation and local anesthesia. The sedation with morphine, diazepam or other sedative drugs can cause respiratory depression and lead to acute respiratory failure after bronchoscopy. Also the bronchoscopy itself can lead to decreased pulmonary function<sup>20</sup>.

An acute decrease in the arterial PO<sub>2</sub> also occurs during bronchoscopy and tends to persist for several hours<sup>21</sup>. Supplemental oxygen should be administered during the procedure and the patients oxygen status should be observed carefully thereafter.

Fever and pulmonary infiltrates also occur following bronchoscopy<sup>22</sup>. But most important complications of TBLB are pneumothorax and hemoptysis. This study demonstrates that pneumothorax is the most common complication of TBLB. In the 68 cases, 8 cases (11.8%) have had pneumothorax and closed thoracotomy was done in 5 cases (7.4%) of them. Cortes et al<sup>13</sup>, reported that pneumothorax occurred in 5.5% from the

biopsy procedure and was the most frequent complication, and the frequency of pneumothorax could not be correlated with three technical factors; the size of the biopsy forceps, the number of biopsies obtained per procedures, and the total number of procedures performed. Fatal cases due to tension pneumothorax were reported. Any patients who develop pneumothorax should be closely observed for more than eight hours in a facility where a thoracostomy tube can be inserted immediately.

Any type of biopsy can lead to hemoptysis, and hemorrhage estimated at greater than 50 ml occurred in 3 cases (4.4%) in this study. None of them died of severe bleeding or required open thoracotomy. But fatal hemoptysis following TBLB has been reported by Zavala<sup>9)</sup>. So the patients selected for TBLB should undergo screening for abnormalities of hemostasis.

Tests of prothrombin time, partial thromboplastin time, and platelet counts should be done on all patients. Also bleeding time should be determined in patients with a history of coagulopathy. Bleeding time will detect abnormalities in platelet function which are not detected by the other tests. Such abnormalities are prone to occur in uremia, hematologic malignancies, and as a consequence of drug administration<sup>24)</sup>. Currently Zavala introduced the wedge method to control hemorrhage<sup>25)</sup>. The procedure consists of securely lodging the tip of the fiberoptic bronchoscope into the selected distal bronchus before, during, and after TBLB.

After biopsy, the forcep is withdrawn through but the fiberoptic bronchoscope is left firmly in the place to prevent bleeding from the tracheobronchial tree. If within a minute no evidence of bleeding is seen at the tip of the bronchoscope, the instrument is withdrawn and other areas are chosen for additional biopsies. If hemorrhage occurs, the bronchoscope is kept in the wedge position for four or five minutes to allow time for a clot to form.

The cause of cardiac arrhythmia during fiberoptic bronchoscopy is not known. In many medical centers, the standard procedure is to monitor EKG only in high risk patients or those who have a history of cardiovascular diseases<sup>23)</sup>.

In this study, the incidence of premature ventricular contractions is 2 cases (2.9%). It has been reported that acute myocardial infarction or other serious arrhythmias might occur, but none was observed in our study.

Mediastinal emphysema has rarely occurred

and no specific treatment is usually required because the mediastinal air will be absorbed if the patient inspires high concentration of oxygen. On rare occasions, the mediastinal air can compress the veins in the mediastinum, impeding venous return and resulting in hypotension. In such cases surgical decompression of the mediastinum should be performed, usually through needle aspiration of mediastinostomy just above the suprasternal notch<sup>26)</sup>.

Other potential complications are as follows; laryngospasm, bronchospasm, flooding the airway from a ruptured lung abscess and death. But in this study, there is no complication, as described above.

We have found that TBLB may be useful for a specific diagnosis in a number of different lung diseases. Although TBLB is generally considered a safe procedure, serious complications may occur.

This study resented the potentially serious complications as pneumothorax, hemorrhage, cardiac arrhythmia and mediastinal emphysema. The guidelines have been established and adopted by University of Tennessee Medical Center regarding contraindications of TBLB.

## REFERENCES

1. Sackner MA: *Bronchofiberscopy*. *Am Rev Respir Dis* 111:62, 1975
2. Scheinhorn DJ, Joyner LR, Whitcomb ME: *Transbronchial forceps lung biopsy through fiberoptic bronchoscope in pneumocystis carinii pneumonia*. *Chest* 66:294, 1974
3. Anderson HA, Fontana RS: *Transbronchial lung biopsy for diffuse pulmonary disease; Technique and results in 450 cases*. *Chest* 62:125, 1972
4. Levin DC, Wicks AB, Ellis JH Jr: *Transbronchial lung biopsy via fiberoptic bronchoscope*. *Am Rev Respir Dis* 110:4, 1974
5. Scheinhorn DJ, Joyner LP, Whitcomb ME: *Transbronchial forceps lung biopsy through fiberoptic bronchoscope in pneumocystis carinii pneumonia*. *Chest* 55:294, 1974
6. Jackson C, Jackson CL: *Bronchoesophagology*. Saunders Philadelphia, p 39-41, 1950
7. Ikeda S: *Atlas of flexible bronchofiberscopy*. Baltimore, University Park Press, 1974
8. Sackner MA: *State of the art; Bronchofiberscopy*. *Am Rev Respir Dis* 111:62, 1975
9. Zavala DC: *Diagnostic fiberoptic bronchoscopy; Techniques and results in 600 patients*. *Chest* 68:12, 1975
10. Zavala DC: *Pulmonary hemorrhage in fiberoptic*

- transbronchial biopsy. *Chest* 70:584, 1976
11. Andersen HA, Fontana RS, Harrison EG, JR: *Transbronchoscopic biopsy in diffuse pulmonary diseases. Dis Chest* 48:187, 1965
  12. Fennessy JJ: *Bronchial brushings and transbronchial forceps biopsy in the diagnosis of pulmonary lesions. Dis Chest* 53:377, 1968
  13. Cortes DA, Mc Dongall JC: *Biopsy and brushing of peripheral lung cancer with fluoroscopic guidance. chest* 75:141, 1979
  14. Ellis JH Jr: *Transbronchial lung biopsy via the fiberoptic bronchoscope; Experience with 107 consecutive cases and comparison with bronchial brushing. Chest* 68:524, 1975
  15. Mohsenifer Z, Chopra SK, Simmons DH: *Diagnostic value of fiberoptic bronchoscopy in metastatic pulmonary tumors. Chest* 74:369, 1978
  16. Koerner KK, Sakowitz AJ, Appleman RI: *Transbronchial lung biopsy for the diagnosis of sarcoidosis. N Engl J Med* 293:268, 1975
  17. Winterbauer RH, Hammer SP, Hallman KD: *Diffuse interstitial pneumonitis, Clinicopathologic correlation in 20 patients treated with prednisone/azathioprine. Am J Med* 65:661, 1978
  18. Cunningham JH, Zavala DC, Corry RJ: *Trephine air drill, bronchial brush, and fiberoptic transbronchial lung biopsies in immunosuppressed patients. Am Rev Respir Dis* 115:213, 1977
  19. Nishio JN, Lynch JP: *Fiberoptic bronchoscopy in the immunocompromised host: The significance of a "non-specific" transbronchial biopsy. Am Rev Respir Dis* 121:307, 1980
  20. Salisbury BG, Metzger LF, Altose MD: *Effect of fiberoptic bronchoscopy on respiratory performance in patients with chronic airway obstruction. Thorax* 20:441, 1975
  21. Albertin RE, Harrell JH, Kurihara N: *Arterial hypoxemia induced by fiberoptic bronchoscopy. JAMA*, 230:1666, 1974
  22. Pereira W, Kovnat DM, Khan MA: *Fever and pneumonia after flexible fiberoptic bronchoscopy. Am Rev Respir Dis* 112:59, 1975
  23. Pereira W, Kovnat DM, Snider GL: *A prospective cooperation study of complications following flexible fiberoptic bronchoscopy. Chest* 73:813, 1978
  24. Bithell TC: *The diagnostic approach to the bleeding disorders. In Clinical Hematology, ed. 7 (Winthrobe MM, Lee GR, Boggs DK) Philadelphia, Lea & Febiger 1043-1073, 1974*
  25. Zavala DC: *Pulmonary hemorrhage in fiberoptic transbronchial biopsy. Chest*, 70:584, 1976
  26. Munsell WD: *Pneumomediastinum. A report of 28 cases and review of the literature. JAMA* 202:689, 1967