Bronchofiberscopy With Curette Biopsy and Bronchography in the Evaluation of Peripheral Lung Lesions*

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Flexible bronchofiberscopy using a double-hinged curette biopsy and under fluoroscopic guidance was performed on 46 patients with peripheral lung carcinomas smaller than 2 cm. Prior mapping of the location of the lung lesion was achieved with selective peripheral bronchography. With these diagnostic tools, a positive cytologic diagnosis for lung carcinomas was made in 45 of 46 patients, a yield of 97.8 percent. Complications associated with the curette biopsy included minor bleeding in three cases and pneumothorax requiring a chest tube in one case.

Materials and Methods

From January 1969 to December 1977, 400 peripheral lung cancer cases were resected at the National Cancer Center Hospital. In the routine workup of these patients before thoracotomy was a chest roentgenogram, lung tomograms, sputum cytology, and bronchography, including the use of selective peripheral bronchogram and the Machida flexible bronchofiberscope (Model FBS-5, FBS-6TII, FBS-6TILII, Machida Endoscope Co Ltd).

Of these 400 lung cancer cases, 52 fulfilled the criteria of “early” lung cancer, i.e., the resected tumor was less than 2.0 cm in diameter and without metastases.† These 52 cases form the basis of this review. There were 33 males (all cigarette smokers) and 19 females (all nonsmokers), with a mean age of 54 years (range, 31 to 78). The majority of patients (35 of 52) were between the fifth and seventh decade of life.

To evaluate the peripheral solitary nodule or infiltrate, bronchography was performed initially to determine the site of the lesion. Bronchography was performed with a flexible bronco-catheter FBC-6 (Machida Endoscope Co Ltd, Fig 1). The patient’s pharynx and larynx were sprayed with 2 percent xylocaine solution, and then the flexible broncho-catheter was inserted transorally into the trachea. A 2 percent xylocaine solution was injected into the bronchi of the affected left or right lung through the open channel tube of the flexible broncho-catheter with the aid of x-ray fluoroscopy. The tip of the broncho-catheter was wedged into the respective distal bronchi, and aqueous Dionosil contrast material was gradually injected into the different segmental orifices and surrounding bronchi with the guidance of fluoroscopy. Standard spot exposure roentgenograms were obtained in addition to magnification spot roentgenograms, the latter with a 50-μ focal spot x-ray tube (Toshiba Co, Fig 2). Bronchofiberscopy was performed approximately seven to ten days after bronchography. The bronchography procedure takes about 30 minutes.

Under local anesthesia with xylocaine spray, bronchofiberscopy was performed through a transorally inserted endotracheal tube.‡ The information obtained from the selective peripheral bronchography regarding the site of the tumor was used to guide the insertion of the double-hinged curette catheter through the biopsy channel of the bronchofiberscope. The curette catheter was advanced and directed to the lung lesion with the aid of fluoroscopy. The curette could be

*Lung cancers can be divided into two major types based on anatomic location: the “hilar” (or “central”) type and the “peripheral” type.1,2 Benfield and associates3 observed that at least 60 percent of all carcinomas of the lung originate in the periphery of the lung and subsequently spread centrally. It is the peripheral lung lesion, detected early, that offers a relatively good prognosis.4,5 In peripheral lung cancers the diagnostic yield of bronchofiberscopy with forceps biopsies, brushings, and washings ranges from 48 percent to 80 percent.5,6 This variable diagnostic accuracy for a positive cytologic answer in peripheral lung carcinomas may be due to different diagnostic techniques and size of lesions. However, Tsuboi et al9 at the National Cancer Center Hospital in Japan reported a diagnostic yield of 92.8 percent for peripheral lung tumors (smaller than 2 cm) after using a specially designed, single-hinged curette through a modified Metras bronchial catheter with fluoroscopic guidance. This study reviews our experience in diagnosing peripheral lung carcinomas with a double-hinged curette1 for obtaining biopsies through the flexible bronchofiberscope under fluoroscopic guidance. Before the bronchosopic procedure, mapping of the location of the peripheral lung lesion was done with a selective peripheral bronchogram.
flexed to 40° and rotated with the distal handle of the catheter. The curette scraped the lesion several times, then the bronchoscope was withdrawn together with the curette at the distal end of the bronchoscope. A second bronchoscope was inserted through the endotracheal tube to evaluate any bleeding and to suction any blood present from the curette biopsy. The curette specimen was put immediately onto a slide, and the slide was immersed in a 95 percent alcohol solution for cytologic evaluation. Two or three curette biopsies were performed at each procedure, and biopsy forceps were not used.

RESULTS

The chest roentgenographic pattern of the peripheral lung lesions of the 52 patients was divided into the three types shown in Table 1. Almost all of the lesions were distinct solitary nodules or indistinct infiltrates. The location of the peripheral lung lesion is shown in Figure 3. Both upper lobe bronchi were involved in 33 cases (63 percent).
Using the curette biopsy to obtain the specimen for cytologic examination, a positive diagnosis for lung carcinoma was achieved in 45 of 46 patients, a yield of 97.8 percent. The remaining six patients refused bronchofiberscopy. Of this group, one had a diagnosis of malignancy made by needle biopsy, and the other five patients had the diagnosis of lung carcinoma obtained by thoracotomy. In five of 46 patients (11 percent) a second bronchofiberscopy with curette biopsy was required before a positive cytologic diagnosis could be made. The average time for a bronchofiberscopy procedure, excluding the topical anesthesia to the oral pharynx and the insertion of the endotracheal tube, was about 30 minutes. Complications associated with the curette biopsy included minor bleeding in three cases, which were self-limited and did not require blood transfusions, and pneumothorax requiring a chest tube in one case. Broken curettes retained in the lungs were not observed.

Selective peripheral bronchograms were valuable in the localization of the tumor in the 46 cases in which bronchofiberscopy and curette biopsy were done. The following case illustrates the usefulness of selective peripheral bronchograms. The patient was a 65-year-old male smoker who had no respiratory symptoms, but a routine chest roentgenogram during a community-wide chest roentgenographic survey for lung cancer among high-risk patients who are smokers showed a peripheral solitary lung lesion. Multiple sputum cytologies were negative for tumor cells. Chest roentgenograms, routine bronchography, and a selective peripheral bronchogram were performed (Fig 4A to 4C). After identifying the tumor site in the B\textsuperscript{4} subsegmental "b" bronchus (Fig 4B), a double-hinged curette was directed to that area via the bronchofiberscope under fluoroscopic guidance (Fig 4C). A diagnosis of adenocarcinoma was obtained from the curettage material.

The cell types of the surgically resected specimens were adenocarcinoma in 41 patients (79 percent) and squamous cell carcinoma in eight patients (15 percent); one patient had a small-cell carcinoma, one a large-cell carcinoma, and one an adenosquamous cell carcinoma. The resected tumors were smaller than 1 cm in diameter in 12 patients and 1 cm to 2 cm in 40 patients. These cases had diagnosis and treatment during a period from January 1969 to June 1979; 33 of the patients (64 percent) have survived for five years or more.

**Discussion**

In cases of peripheral lung carcinoma, the diagnostic accuracy for peripheral lung carcinoma with the flexible bronchofiberscope, using either the biopsy forceps or bronchial brushes, varies between 48 percent and 80 percent.\textsuperscript{88} Using a 1.7-mm nylon brush mounted on a steel guide wire, Richardson et al\textsuperscript{7} made a diagnosis of lung carcinoma in 41 of 52 patients (79 percent) with mid or peripheral mass on a chest roentgenogram. Shoenbaum et al\textsuperscript{6} used biopsy forceps in ten peripheral lung carcinomas ranging from 1.3 cm to 6 cm in diameter and obtained a positive diagnosis for malignancy in eight (80 percent); the positive yield with the biopsy forceps was in lesions 3 cm or wider.

It is the small peripheral lesion, 2 cm or smaller, that may be difficult to diagnose with forceps biopsy or bronchial brushings. In an earlier study at this institution, Tsuboi et al\textsuperscript{8} used a specially designed single-hinged curette through a Metras' bronchial catheter for peripheral lung carcinomas smaller than 2 cm and had a positive cytologic diagnosis in 13 of 14 patients (92.8 percent). With the development of the flexible bronchofiberscope by Ikeda,\textsuperscript{1} the bronchofiberscope was used together with a double-hinged curette. The proximal part of the double-hinged curette used in this study can be flexed to 40°, leading to a 95° flexion of the distal curette cup. In addition, this curette has greater flexibility, mobility, and directional guide than the routine biopsy forceps and bronchial brushes. Although the double-hinged curette is a delicate instrument, it is able to scrape or curettage in or around a lung lesion.
in a vigorous fashion. After curettage, it is withdrawn together with the bronchofiberscope from the endotracheal tube.

The double-hinged curette is to be used for peripheral lung lesions and not for central lesions in which the biopsy forceps and bronchial brushes are preferred. Most bronchoscopists in the United States do not use the curette biopsy instruments. However, Zavala demonstrated a diagnostic yield of 76 percent with the single-hinged curette in 13 of 17 patients with peripheral bronchogenic carcinoma in which the tumor was not visible endoscopically. In contrast, there was a positive cytologic diagnosis of 69 and 70 percent, respectively, when the biopsy forceps and bronchial brushes were used.

Although the bronchofiberscope is a valuable diagnostic tool for the evaluation of lung cancer, the positive diagnostic yield for peripheral lung lesion has been about 70 percent using biopsy forceps and bronchial brushes but without bronchography or curette biopsy. Even with a selective peripheral bronchogram and the double-hinged curette, a small proportion of our patients required a second bronchoscopic procedure before a cytologic diagnosis was achieved. This further emphasizes the occasional difficulty of obtaining a diagnostic yield in peripheral lung lesion.

Bronchography has been used by various investigators for the evaluation of lung cancer, but it has not been used widely in the evaluation of suspected lung carcinoma in patients in U.S. medical centers. Fraser and Pare do not recommend bronchography in the radiologic evaluation of suspected bronchogenic carcinoma, since the bronchofiberscope can visualize the airways down to the subsegmental bronchi. However, in a small peripheral lung lesion, there is usually no endobronchial lesion, no stenosis of the bronchial orifice, and no abnormal mucosa pattern suggestive of carcinoma. Thus, the endoscopist has no guide to help direct the biopsy forceps or curette biopsy catheter, as is the case in most central types of carcinoma.

Stittik and Proctor used tantalum bronchography for the evaluation of radiologically occult bronchogenic carcinoma. They observed that if tantalum bronchography was done before bronchoscopy, the time spent in bronchoscopy to look for an occult lung cancer would be significantly decreased. It should be noted that tantalum is an experimental contrast agent that has not been approved for routine use in the United States.

At the National Cancer Center in Japan, selective bronchography is used routinely in evaluating a peripheral lung lesion. In patients with positive sputum cytology for malignant cells but with a normal chest roentgenogram, bronchography may help in localizing the abnormal bronchus. We agree with Fraser and Pare that bronchography may not be necessary for the central type of bronchogenic carcinoma, but the selective peripheral bronchograms are valuable in identifying the exact location of a peripheral solitary lung lesion in the subsegmental bronchi of the bronchial tree. One can guide the curette directly to the affected subsegmental orifices without exploring other subsegmental bronchi. In addition, fluoroscopy is indispensable during the procedure and complements the bronchogram in directing the curette biopsy catheter to the site of the tumor. The time spent in performing bronchofiberscopic examination is reduced.
We were able to achieve a high diagnostic yield (97.8 percent) in the detection of peripheral lung carcinoma by using a combination of diagnostic tools—selective bronchography followed by bronchofiberscopy with curette biopsy under fluoroscopic visualization. The double-hinged curette catheter should only be used by bronchoscopists experienced with this technique.

REFERENCES
1 Ikeda S. Atlas of flexible bronchofiberscopy. Tokyo; Igaku Shoin Ltd; Baltimore; University Park Press, 1974

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CHEST, 79: 2, FEBRUARY, 1981