Use of the Bronchofiberscope for Bronchial Brush Biopsy

Diagnostic Results and Comparison with Other Brushing Techniques*

Donald C. Zavala, M.D.; Robert H. Richardson, M.D.; Prashant K. Mukerjee, M.D.; Nicholas P. Rossi, M.D., F.C.C.P.; and George N. Bedell, M.D., F.C.C.P.

The flexible bronchofiberscope was used to perform bronchial brush biopsies in 75 patients with central, midlung and peripheral lung lesions suspected of being malignant. Of the 52 patients who had lung cancer, a positive or highly suspicious cytology was obtained in 46 (89 percent), compared to a diagnostic accuracy of 72 percent in a previous series using rigid, premolded catheters, and 82 percent using a mobile, controlled-tip catheter. Direct placement of the brush on endoscopically visible tumors produced positive results in 32 of 34 patients (94 percent), whereas only 14 of 18 patients (78 percent) with peripheral bronchogenic carcinomas were correctly diagnosed by indirect fiberoptic brushing under fluoroscopic control. In distal, inaccessible lesions, the problem may be solved using a mobile, controlled-tip catheter or the recently modified curette.

The flexible bronchofiberscope, described by Ikeda and colleagues in 1968, has proved to be a major advance in the diagnosis and management of bronchopulmonary diseases. This unique instrument has opened a new era in the earlier diagnosis of intrabronchial lesions. Chest physicians now may be trained in fiberoptic bronchoscopy, a procedure which has several distinct advantages over rigid bronchoscopy: (1) increased visual range, especially in the upper lobes; (2) minimal discomfort to the patient; (3) direct and indirect biopsy of many tumors previously inaccessible; (4) improved photography and cinematography.

Bronchial brush biopsy through the fiberoptic bronchoscope was employed initially by Ikeda and later discussed enthusiastically by Fennessey, Fontana and Faber, but no extensive analysis of this combined technique has been reported.

This study describes the new method of bronchial brushing through the bronchofiberscope and reports our results using the technique of direct brush biopsy on fiberoptically visible lesions, and indirect brush biopsy under fluoroscopic control on more peripheral lesions. These results are compared to those obtained using nonmobile and mobile catheters.

Materials and Methods

During the past 13 months, we have performed brush biopsies through an Olympus BF-5B fiberoptic bronchoscope on 75 patients with central, midlung and peripheral lung lesions suspected of being malignant. Prior examination with a rigid bronchoscope in 15 patients had yielded negative diagnostic results. In the series there were 33 men and 12 women of ages from 41 to 83 years, average 61. Fifty-three lesions were located in one of the upper lobe segments, eight in the right middle lobe, and 14 in one of the lower lobe segments.

Tissue diagnosis was confirmed by thoracotomy in 36 patients, by extrapulmonary biopsy of metastatic lesions in
four patients, by trephine lung biopsy in three patients, by postmortem examination in five patients, and by clinical follow-up for five or more months in the remaining 27 patients. Seven of these 27 patients subsequently died and were judged to have carcinoma because of relentless progression of their disease, although postmortem examinations were not obtained.

The Olympus BF-5B bronchofiberscope has an outer diameter of 5 mm and a small inner channel used for installation of anesthetic solutions, aspiration of secretions or lavage solutions, and insertion of a bronchial brush for tissue biopsy and culture. The bronchofiberscope is illuminated by a xenon cold light supply. The flexible section and inner channel of the instrument may be cold sterilized in providone-iodine germicide* (Betadine) for 20 minutes or gas sterilized. The above equipment has been described in previous articles.1,2

The examinations were done in a biopsy room equipped with a TV fluoroscope and image intensifier.

**Preparation of the Patient**

Informed consent is obtained from the patient. Recent chest films are reviewed and, when advisable, tomograms are taken. The usual premedication is 7.5 to 15 mg morphine sulfate and 0.6 mg atropine sulfate given by intramuscular injection 30 minutes prior to the procedure. The stomach should be empty. The only contraindications are lack of patient cooperation and active, untreated pulmonary tuberculosis.

With the patient sitting, topical anesthesia is achieved with a 0.5 percent lidocaine (Dyclone) gargle, followed by repeated spraying of the oropharynx with 5 to 10 ml of 4 percent lidocaine in a No. 15 DeVilbiss atomizer. Each pyriform sinus is blocked by local application of cotton balls soaked in 4 percent lidocaine. Then 5 ml of 1 percent lidocaine is delivered slowly through a curved cannula down the back of the tongue into the trachea.

**Tracheal Tube Insertion**

When local anesthesia has been accomplished, the vocal cords may be examined with a headlamp and laryngeal mirror, or the bronchofiberscope. Next, a 34F flexible endotracheal tube** is inserted into the trachea without the aid of a mirror or laryngoscope. The maneuver is rather simple and is almost always successful. The tracheal tube containing the malleable stylet is bent into the shape shown in Figure 1, inserted into the oropharynx over the back of the tongue and epiglottis, staying in the midline. The operator may check the position of the tube with his finger. When the end of the tube is resting just over the vocal cords, the operator pulls upward on the stylet while pushing the tube forward. The distal end of the tube will bend anteriorly and, in most instances, drop into the trachea. Difficulty phonating plus air movement through the tube indicates that the trachea has been entered. Another 5 ml of 1 percent lidocaine is injected through the tube into the trachea, and the patient is placed supine for passage of the bronchofiberscope. Small amounts of additional 1 percent lidocaine may be used as required during the examination.

An alternate method of tracheal tube insertion may be used by backing the tube up over the shaft of the fiberoptic instrument, passing the bronchofiberscope through the oropharynx.

*2 parts Betadine solution 10 percent, 1 part alcohol 70 percent, and 1 part water.

**Supplied with the Olympus bronchofiberscope.

**Figure I. Shape and position of endotracheal tube for insertion.

into the trachea under visual control, then sliding the tracheal tube down into place.

**Fiberoptic Bronchoscopy with Biopsy**

The bronchofiberscope is passed down the previously positioned tracheal tube. Following inspection of the tracheobronchial tree, including all segmental (B-1 to B-10) and subsegmental bronchi, the brush is inserted down the inner channel and any visible lesion is biopsied. More peripheral lesions are brushed under fluoroscopic control (Fig 2A, B). The goal is to brush directly on the lesion, entrapping bits of tissue on the brush bristles.

 Routinely, three separate brushings are taken. After each biopsy, the brush is drawn back just to its exit porthole, and the entire instrument is withdrawn. The brush is then advanced from the bronchofiberscope into a tube of sterile Ringer's solution and manually agitated to remove bits of tissue. Any mucus in the channel tip is flushed into the same reservoir tube which is sent to the cytology laboratory for collection of the tissue contents on a millipore filter, followed by Papanicolaou staining. A portion of the Ringer's solution may be centrifuged for inoculation of the sediment on appropriate media.

Before concluding the procedure, the bronchofiberscope is reinserted, and washings are taken from the biopsy site using 5-10 ml of Ringer's solution. The lavage solution is introduced through the inner channel, and collected into a suction trap by the same route. This specimen also is submitted for bacteriologic and cytologic examination, including a cell block. Postbronchoscopy orders withhold food and drink until gag and swallowing reflexes return, which usually takes no more than one hour.

**Selection of Patients**

Special comment is indicated regarding patients with severely compromised pulmonary function. Hypoxemia and hypercarbia per se are not contraindications in experienced hands. The only preprocedure medication given is atropine 0.6
mg and occasionally codeine 60 mg. Morphine and/or Valium are omitted. A 34Fuffed endotracheal tube is inserted in high risk patients (by the method already described) so that the cuff may be inflated and the patient ventilated, if necessary. Oxygen may be given effectively through the fiberscope when the channel is not being used for other purposes, through the tracheal tube, or by nasal catheter if the cuff is not inflated.

RESULTS

In this series of 75 patients, 52 had bronchogenic carcinoma and 23 had nonmalignant disease. Positive or highly suspicious cytology was obtained in 46 (89 percent) of the 52 patients with lung cancer, compared to a diagnostic accuracy of 72 percent in a previous series using rigid, premolded catheters, and 82 percent using a mobile, controlled-tip catheter (Table 1).

Results were analyzed by dividing the 75 patients into three groups according to cyto logic classification. The first group consisted of 28 patients with benign cytology, of whom six had bronchogenic carcinoma. The second group was made up of ten patients with strongly suspicious cytology, of whom nine had malignant disease. The one patient with a false positive report had a lobectomy and was found to have an organizing pneumonia. The third group was comprised of 37 patients with positive cytology, all of whom had bronchogenic carcinoma.

The results then were reviewed by dividing the 52 patients with lung cancer into two groups according to the location of their tumors. One group consisted of 34 patients with central and midlung lesions which were brushed under direct vision of the bronchofiberscope. In this group with endoscopically visible lesions, 27 were cytologically positive, five strongly suspicious, and two negative for carcinoma.

One of the two patients with false negative cytology subsequently died, and at postmortem examination, the tumor mass was surrounded by a thick layer of inflammatory tissue.

The other group was comprised of 18 patients with peripheral lung lesions which were beyond the visual range of the bronchofiberscope but, nevertheless, were brushed through the fiberoptic instrument under fluoroscopic control. Of these 18 patients, ten were cytologically positive and four strongly suspicious for carcinoma. The four patients with false negative reports had 1.5 to 3 cm peripheral coin lesions, three of which were inaccessible to the brush.

In addition to obvious tumor masses, other fiberoptic observations were noted. Blood, without a visible lesion, was seen coming from a segmental orifice in five patients, all of whom subsequently were proved to have a malignancy. One of these patients, a 55-year-old man whose only symptom was hemoptysis, had normal findings on x-ray film of the chest. Purulent material was observed exuding from

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<th>Table 1—Results of Three Methods of Bronchial Brush Biopsy in 200 Patients with Suspicious Lung Lesions (U. of Iowa)</th>
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<td>Nonmobile Catheter</td>
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<td>Total No. patients</td>
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<td>No. with bronchogenic carcinoma</td>
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one or several segmental orifices in four patients, and diffuse inflammatory changes involving the bronchial mucosa were seen in three additional patients, all of whom had nonmalignant disease. Inoperability was determined endoscopically in six patients by involvement of the trachea and/or a widened, fixed carina.

Complications were almost nonexistent. One patient had mild, transient hemoptysis secondary to biopsy. Pneumothorax did not occur.

**DISCUSSION**

This report describes the new technique of bronchial brushing through the bronchofiberscope in a manner similar to that used by Ikeda.12 A major advantage of this method is the combination of flexible endoscopy and bronchial brushing in a single procedure. Diagnostic accuracy for malignancy has been increased to 89 percent, as compared to 53 percent using the rigid bronchoscope,11 66-78 percent using nonmobile catheters,6-8 and 80-82 percent using a mobile catheter.6-8-10

The advantages of passing the fiberoptic bronchoscope down a previously placed endotracheal tube, in contrast to the transnasal route described by Smiddy and associates,13 have been pointed out by Richardson.14 The instrument is easier to manipulate and can be rapidly and atraumatically withdrawn and reinserted repeatedly for multiple biopsies or clearing of the distal lens.

Visible lesions are brushed directly. Contact of the fiberscope brush with the surface of a malignant tumor, usually, but not always, will yield material positive for cancer. In our series, 32 of 34 patients (94 percent) with endoscopically visible tumors had positive or highly suspicious cytology, whereas only 14 of 18 patients (78 percent) with peripheral bronchogenic carcinomas were correctly diagnosed by fiberoptic brushing under fluoroscopic control. In three of the four patients with false negative cytology, the operator was unable to position the brush on the lesion.

Communication between the clinician and cytopathologist is important. Our cytology reports were written in a narrative style. Accuracy in making a tissue diagnosis is dependent upon proper positioning of the brush, good procedural techniques in collecting tissue samples, and accurate cellular interpretation by an experienced cytopathologist. In previous studies, it was observed that the millipore filter specimens were uniformly superior to glass slide smears.6-10 In this present work, we relied entirely on the millipore technique and cell buttons. False negative results will always be present to some degree. In the group of ten patients with strongly suspicious cytology, there was one false positive report. The 37 patients with definitely positive cells for malignancy all had bronchogenic carcinoma.

It was concluded that fiberoptic bronchoscopy with brush biopsy is an excellent procedure for the diagnosis of central and midlung lesions, but in peripheral lesions, diagnostic accuracy is decreased due to difficulty in getting the brush on target. In cases of failure to put the brush on the lesion, our present procedure is to remove the fiberoptic instrument and to brush through the mobile, controlled-tip catheter.1 Of the other fiberoptic biopsy tools now available, the recently modified curette seems to be the most promising because of its mobility, maneuverability, and capability to scrape fairly deep into any tissue mass.

*Made by Medi-Tech, Inc, Watertown, Massachusetts.

**REFERENCES**


CHEST, VOL. 63, NO. 6, JUNE, 1973