Transbronchial Needle Aspiration for Histology Specimens

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Fine-gauge (22-G) transbronchial needle aspiration (TBNA) has significantly added to the diagnostic yield of FOB, and in some institutions has become routine in staging bronchogenic carcinoma. Cytologic examination of the specimen obtained by 22-G TBNA, however, has several limitations. The mediastinal aspirate can be contaminated by tumor cells from respiratory secretions, giving false positive diagnoses of unresectability. The diagnosis of benign conditions can seldom be made. Using 18-G TBNA, we can obtain specimens for histologic examination from paratracheal, peribronchial, and carinal areas by FOB. Both 18-G and 22-G TBNA were performed in 34 patients with radiographic abnormalities involving mediastinal or hilar areas. Tissue for histologic examination was obtained in 17 patients (50 percent) using 18-G TBNA and was diagnostic in 11 (32 percent), including three patients with benign conditions. The overall diagnostic yield of 18-G TBNA was 41 percent (14/34 patients), increasing the yield of FOB from 50 percent to 58 percent. There were no false positive results and few minor complications. 18-G TBNA is effective in obtaining tissue for histologic examination and diagnosing benign conditions. In selected cases this technique increases the diagnostic yield of FOB. (Chest 1989; 96:1228-32)

22-G = 22-gauge; TBNA = transbronchial needle aspiration; FOB = fiberoptic bronchoscopy;

The role of fine-gauge flexible TBNA for obtaining specimens through the FOB for cytologic examination is well established. Indications extend from staging of bronchogenic carcinoma to diagnosing bronchogenic cysts.1-12 The limitations of this technique are summarized in Table 1. Only cytologic specimens can be obtained using the 22-G needle. Cytologic interpretation requires optimally prepared specimens as well as experienced personnel. The aspirate obtained from the mediastinum can be contaminated by tumor cells from respiratory secretions or by aspiration of a malignant but noninvasive lesion close to the mediastinum; this can be falsely interpreted as N2 or N3 disease.13-15 A micrometastasis from an ipsilateral paratracheal area (N2) can be interpreted as unresectable disease in a patient with squamous cell carcinoma, where surgery could still be beneficial.3 On occasion, the distinction among small cell carcinoma, carcinoid tumor, and lymphoma may not be established based on a cytologic specimen even by an experienced cytopathologist. A major limitation of 22-G TBNA examination is that the diagnosis of benign conditions can seldom be established.16

Many of these problems can be overcome if a tissue specimen is obtained from the mediastinum or hilar areas for histologic examination. This can be achieved by either mediastinoscopy or thoracotomy, but such approaches are invasive, requiring general anesthesia and hospitalization. In 1985, Wang et al17 showed that a core of extrabronchial tissue can be safely obtained for histologic examination from either the mediastinum or hilar areas using a modified Turner's needle through a rigid bronchoscope. In their studies, accurate diagnosis of malignant as well as benign conditions was established in 70 percent of patients by histologic examination. An earlier study from France, using a similar needle through the rigid bronchoscope, demonstrated a 53 percent yield in diagnosing various stages of sarcoidosis.18 However, most pulmonologists are not proficient with the rigid bronchoscope used in these studies. The technique of using the rigid bronchoscope is relatively invasive, usually requiring general anesthesia. Rigid bronchoscopy using local anesthesia is associated with a great deal of patient discomfort and is not well tolerated.

Recently, Wang19 introduced a flexible version of this needle for easier application through the FOB. In his preliminary study, he successfully obtained specimens for histologic examination from mediastinal and hilar areas in a majority of patients without complications.19

The present study deals with the Cleveland Clinic

Table 1—Limitations of Cytologic Studies of TBNA Specimens

| Requires an experienced cytopathologist | Requires laboratory sophistication | Value limited to malignant conditions only | False positive results (staging) | Overinterpretation (staging) | Misinterpretation of findings |

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Transbronchial Needle Aspiration for Histology Specimens (Mehta et al)
experience using the 18-G needle to obtain specimens for histologic examination. The purpose of our study was to reproduce the published data, to study the effect of the 18-G TBNA on overall diagnostic yield of FOB, and to compare the 18-G with the 22-G needle.

METHODS AND MATERIAL

FOB was performed in patients with radiographic evidence of hilar, subcarinal, paratracheal abnormalities. Patients with exophytic or obvious submucosal processes were excluded. Bronchoscopic evidence for extrinsic compression was usually present prior to performing either 22-G or 18-G TBNA. Washing, brushing, and 22-G TBNA were performed prior to 15-G TBNA. The 22-G TBNA was performed by the previously published method. The primary purpose of the 18-G TBNA was to establish the diagnosis. Where applicable, this information was used for staging. Decision to perform 22-G and 18-G TBNA was made during the initial FOB. In no patient was FOB performed or repeated solely for the purpose of staging for either suspected or documented bronchogenic carcinoma. A CT scan of the chest was not a prerequisite; however, if available, the information was used to select the appropriate insertion site. Where applicable, transbronchial biopsy was performed under fluoroscopic guidance.

**Needle Assembly for 18-G TBNA**

At the distal end of this instrument is a 15 mm long, 18-G metal needle with a flat, cone-shaped tip that has an inward tapering cutting edge. The needle is attached to a 120-cm-long flexible plastic catheter with an outer diameter of 2 mm. A 20-G, 5-mm long beveled, retractable needle, attached to a guide wire, is housed within the 18-G needle (Fig 1). The proximal end of the plastic catheter bears two ports, one to accommodate the proximal end of the guide wire with its locking mechanism and the other for applying suction while obtaining a tissue specimen. Movement of the 20-G needle is driven by the proximal end of the guide wire. The arrangement at this end is similar to that of type II A and B flexible transbronchial aspiration needles for cytology specimens.

**Histology Specimen Retrieval**

During the insertion of this assembly, the 20-G needle is retracted within the 18-G needle to prevent trauma to the channel of the submersible fiberoptic bronchoscope (Fig 2, step 1). The 18-G
needle is positioned beyond the distal end of the FOB at the target site. Prior to puncturing the target site, the 20-G needle is extended beyond the 18-G needle and locked in place. The 20-G needle is then inserted through the tracheobronchial wall and suction applied at the proximal end, using a 60-ml syringe containing 3 ml of normal saline solution (Fig 2, step 2). This step is performed to ascertain that the needle is not entering a major intrathoracic vessel. Once this is confirmed, the suction is released, and the 18-G needle is advanced by a few millimeters through the tracheobronchial wall, and the 20-G needle is withdrawn. The 20-G needle prevents plugging of the 18-G needle by mucosa from the tracheobronchial wall. The 18-G needle is inserted through the tracheobronchial wall to its hub (15 mm). One may experience some difficulty during this part of the procedure. To facilitate the insertion of the 18-G needle, the plastic catheter can be stabilized at the proximal end of the FOB channel by using one finger, then the entire scope pushed to advance the needle, while keeping the proximal end of the metal needle within the distal end of the channel so that the body of the scope splits the needle-catheter junction. If 22-G TBNA is performed prior to the 18-G TBNA to obtain cytologic specimens, the same needle track can be used, facilitating insertion of the 18-G needle. One can also ask the patient to cough while the needle is held firmly at the target site to achieve spontaneous penetration of the tracheobronchial wall by the 18-G needle (Fig 2, step 3). Suction is then reapplied and tissue for the histology specimen obtained by moving the 18-G needle in and out (partially) through the tracheobronchial wall at the target site. The assembly is then removed from the scope. Once outside the bronchoscope, the specimen is collected by flushing the needle assembly with normal saline solution present in the 60-ml syringe. On occasion, the 20-G needle is used to push the core of the tissue out of the 18-G needle for histologic examination. Two passes are made at each site using a single disposable needle. Depending on the size of the specimen, either the histologic or the cytologic examination is performed. The specimens are prepared by the usual laboratory methods.

RESULTS

In 34 patients, 18-G TBNA was performed at the hilar, subcarinal, or paratracheal areas depending on the radiographic abnormality. Adequate specimens for histologic examination were obtained in 17 patients. In nine patients, the specimen was either small or fragmented immediately after retrieval, and therefore only cytologic examination could be performed. In three patients, the specimen obtained was inadequate for either histologic or cytologic examination because the aspirate was "dry." In five patients, insertion of the 18-G TBNA needle through the transbronchial wall remained unsuccessful and no specimen was obtained.

Of 17 patients in whom adequate histology specimens were obtained, the procedure was diagnostic in 11. Three patients in part illustrate our experience with 18-G TBNA.

CASE 1

A 62-year-old male smoker presented with Eaton Lambert syndrome and an unremarkable chest roentgenogram. On cytologic examination his sputum demonstrated squamous cell carcinoma, which did not correlate with the clinical impression of small cell carcinoma. FOB revealed a blunted main carina. A histologic specimen obtained using the 18-G TNBA established the diagnosis of small cell carcinoma (Fig 3). The patient was subsequently found to have two separate primaries, squamous cell carcinoma as well as small cell carcinoma.

CASE 2

A 60-year-old man was thought to have had sarcoidosis for 20 years, but the diagnosis was never confirmed. He was referred because of increasing dyspnea. A FOB was performed, but a transbronchial biopsy could not be performed because of marked
tortuosity and distortion of the endobronchial anatomy, presumably due to massive parenchymal fibrosis. A histologic specimen obtained by 18-G TBNA was exclusively diagnostic for sarcoidosis (Fig 4).

CASE 3

A 34-year-old black man presented with a right hilar mass. Lymphoma was clinically suspected, but a histologic specimen obtained by the 18-G TBNA showed granulomatous inflammation. Mediastinoscopy established histoplasmosis as the cause of the right hilar mass.

The overall diagnostic yield of the 18-G TBNA was 41 percent, 32 percent by histologic and 9 percent by cytologic examination. If we exclude the cases without successful insertion, the diagnostic yield increases to 49 percent. In three patients, one with sarcoidosis, one with adenocarcinoma, and one with small cell carcinoma, the 18-G TBNA was exclusively diagnostic; this increased the diagnostic yield of FOB by 16 percent. In two other patients, even though the test was exclusively diagnostic, further confirmation by mediastinoscopy was required to rule out lymphoma in one patient and to confirm the type of lymphoma in the second.

Of the nine patients in whom a histologic specimen could not be obtained and only cytologic examination was performed, it was diagnostic in three patients; one case each of adenocarcinoma, small cell carcinoma, and large cell lymphoma was diagnosed in this fashion. In two of these patients, cytologic study results were exclusively diagnostic. No benign conditions were diagnosed by cytologic study.

Provided that two successful attempts were made with the 18-G TBNA through the tracheobronchial wall, the 22-G needle aspiration did not add to the diagnostic yield of FOB. In other words, if the 22-G needle aspiration specimen was positive, the 18-G TBNA specimen was always positive. On the contrary, cytologic specimens obtained by 18-G TBNA provided higher diagnostic yield than those obtained by 22-G TBNA. Of five patients in whom insertion of the 18-G TBNA was unsuccessful, 22-G TBNA was exclusively diagnostic in two. No benign conditions were diagnosed in this fashion.

CT scans of the chest were not available in seven patients. In three of these patients, the needle aspiration was unsuccessful. The diagnosis of sarcoidosis was established in two patients and small cell carcinoma in one patient by histologic specimens obtained by 18-G TBNA despite the lack of a CT scan of the chest. The remaining patient was established to have no pulmonary disorder in follow-up visits. Of the 27 patients in whom CT scans were available, insertion was unsuccessful in two, while 18-G TBNA was nondiagnostic or did not provide sufficient special material in 14 patients.

The procedure remained nondiagnostic in six patients. Nondiagnostic histology specimens usually demonstrated a normal lymph node with some histiocytes and/or anthracosis (Fig 5). Subsequent evaluation in these six patients established the presence of bronchogenic carcinoma in three, mesothelioma in one, and sarcoidosis in one patient. In the remaining patient, radiographic and endobronchial abnormalities were suspected to be due to silicosis by strong occupational history and review of old chest x-ray films. Results of studies on all histologic specimens retrieved by the 18-G TBNA are summarized in Table 2.

All patients felt discomfort during the insertion of the 18-G needle. Symptoms varied from pressure in the subternal area, discomfort in the nose, and coughing throughout the procedure. Three patients experienced bleeding of less than 50 ml, including aspiration of frank blood in the syringe, and/or endobronchial bleeding from the insertion site. Maximum bleeding of 50 ml occurred in a patient who had mitral valve disease, congestive heart failure, and pleural effusion. No instances of hemomediastinum, pneumothorax, or trauma to the bronchoscope were encountered.

DISCUSSION

Using the 18-G TBNA through FOB, Wang successfully obtained tissue for histologic examination in 21 of 25 patients, establishing the diagnosis in 18 patients. The overall diagnostic yield was reported to be 72 percent. In patients in whom adequate tissue was obtained, the yield increased to 85 percent. Specimens were obtained from the carinal, paratracheal, and hilar areas. Diagnosis of malignant as well as benign conditions, including lymphoma and sarcoidosis, were successfully established. There were no complications and the study established the safety and efficacy of 18-G TBNA. However, the diagnostic yield of the 18-G TBNA was not compared with that of other endoscopic methods.

From our preliminary experience, we found that 18-G TBNA is effective in obtaining specimens for histologic examination from the mediastinum and hilar areas in at least 50 percent of attempts. Diagnosis of malignant as well as benign conditions can be made.

<table>
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<tr>
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<th>TBNA for Histology Specimens*</th>
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<tbody>
<tr>
<td>Condition</td>
<td>Diagnostic</td>
</tr>
<tr>
<td>Small cell carcinoma</td>
<td>5</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>2</td>
</tr>
<tr>
<td>Squamous cell carcinoma</td>
<td>1</td>
</tr>
<tr>
<td>Sarcomiosis</td>
<td>2</td>
</tr>
<tr>
<td>Granulomatous inflammation</td>
<td>1</td>
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<tr>
<td>(histoplasmosis)†</td>
<td></td>
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<tr>
<td>Mesothelioma</td>
<td>0</td>
</tr>
<tr>
<td>Silicosis</td>
<td>0</td>
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<tr>
<td>Total</td>
<td>11</td>
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*Patients studied, 34; histology specimen obtained, 17.
†Confirmed by mediastinoscopy.
successfully. The problem of false positivity and overinterpretation is eliminated because histologic specimens are obtained with the 18-G TBNA, and contamination from tumor cells from the respiratory secretions would not alter the histologic diagnosis. In selected cases, 18-G TBNA increases the diagnostic yield of FOB as well. The procedure is also associated with a low morbidity. Prior CT scan of the chest is desirable but not mandatory. However, we do believe that we would have performed 18-G TBNA more frequently if all patients undergoing FOB had prior CT scans of the chest. CT scan enables identification of smaller mediastinal masses not seen on the routine chest roentgenogram. At the Cleveland Clinic Foundation, CT scan of the chest is generally not performed prior to FOB in patients with suspected bronchogenic carcinoma. The 22-G TBNA adds to the diagnostic yield of FOB only if two passes with 18-G TBNA remain unsuccessful.

Prior experience with 22-G TBNA is helpful. We performed 250 such aspirations before performing 18-G transbronchial aspirations. Paratracheal insertion is technically more difficult than subcarinal or hilar insertion. During the course of this study, it was noted that the new Olympus BFIT20-OES fiberoptic bronchoscope does not admit the 18-G needle through the instrument channel.

In several institutions around the nation, fine-gauge (22-G) TBNA has become a routine staging procedure for bronchogenic carcinoma. We believe that the 18-G TBNA has great potential for widespread acceptance for the same purpose as histologic examinations on specimens thus obtained and eliminates false positivity and overinterpretation. It may also become the procedure of choice for conditions, such as stages I and II sarcoidosis, mediastinal lymphoma, and other mediastinal conditions. This procedure may decrease the number of mediastinoscopies performed for these conditions. It is also likely to limit the use of the 22-G TBNA to conditions such as peripheral nodules. We also expect to see design modifications in the needle assembly that would improve specimen retrieval even in less experienced hands.

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