Transbronchial Needle Aspiration in the Diagnosis of Submucosal and Peribronchial Bronchogenic Carcinoma

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Although exophytic endobronchial lesions can readily be diagnosed by routine forceps biopsy through the fiberoptic bronchoscope, submucosal or peribronchial tumor can be difficult to diagnose with nonsurgical techniques. We evaluated the utility of transbronchial needle aspiration (TBNA) through the fiberoptic bronchoscope in 31 patients presenting with endoscopic abnormalities suggestive of submucosal or peribronchial tumor. TBNA was performed using a 20-g × 1-cm needle, followed by forceps biopsy of the same area. Forceps biopsy was positive in 17 cases (55 percent) and TBNA in 22 (71 percent) (p = .00185). The combination of forceps biopsy and TBNA was positive in 27 cases (89 percent), which was significantly better than forceps biopsy alone (p = .00185). In addition, the wash or the brush detected three additional carcinomas, so the combination of TBNA, forceps biopsy, wash, and brush had a diagnostic yield of 97 percent. We conclude that TBNA significantly increases the yield over forceps biopsy alone in the detection of submucosal or peribronchial bronchogenic carcinoma and that the maximal diagnostic yield is obtained by the combination of TBNA, forceps biopsy, wash, and brush when appropriate endoscopic abnormalities are encountered.

Central bronchogenic carcinoma tends to present in one of three patterns. The growth may be predominantly in the mucosal layer, in which case the tumor presents as a bulky, exophytic mass. It can also spread predominantly in the submucosa, in which case the endoscopic findings are generally those of erythema, loss of the normal bronchial markings, narrowing of the bronchus, or apparent thickening of the mucosa. The third pattern is that of predominantly peribronchial spread, in which case the endoscopic findings are usually narrowing or extrinsic compression of the bronchus. The first pattern is relatively easy to diagnose with standard bronchoscopic forceps biopsy, with reported diagnostic yields close to 100 percent. Submucosal or peribronchial tumor is, however, more difficult to detect by forceps biopsy. The tissue may be firmer in the case of submucosal infiltration, while peribronchial tumor may be largely inaccessible to the biopsy forceps.

Because of these difficulties, we thought it would be useful to evaluate the role of transbronchial needle aspiration in the detection of predominantly submucosal or peribronchial tumor. The needle would have the theoretic advantage of easy penetration through tissue layers that are difficult to access with biopsy forceps. The purpose of this study was to establish the diagnostic yield of transbronchial needle aspiration, specifically in patients with suspected submucosal or peribronchial tumor, to compare the yield to that of forceps biopsy, and to assess its complications.

Methods

Patient Population

Thirty-one patients at the San Diego Veterans Administration Medical Center who were found to have endobronchial lesions suggestive of submucosal or peribronchial tumor during diagnostic fiberoptic bronchoscopy were included in the study. Suggestive abnormalities consisted of erythema, loss of normal bronchial markings, thickening of the mucosal stripes, narrowing of the bronchus, or extrinsic compression. No exophytic mass lesions were present.

Protocol

Informed consent was obtained prior to bronchoscopy. Patients were then premedicated with intravenous (IV) meperidine and topically anesthetized with tetracaine, 0.45 percent. An Olympus ITR fiberoptic bronchoscope (Olympus Corp) was passed transnasally, and the lower airways were examined. The area identified as abnormal according to the criteria listed above was washed with 60 ml of saline solution and brushed with a 3-mm nylon bristle brush. Both washings and brushings were sent for routine cytologic processing.

Transbronchial needle aspiration was then performed in a manner similar to that previously described. An Olympus prototype needle or a Microvasive bronchoscopic aspirating needle (Microvasive, Inc) was used. Both needles are 20 g and 1 cm in length. The needle was passed through the bronchoscope channel in the retracted position and advanced from its outer sheath after the tip of the apparatus had emerged from the bronchoscope. The needle was then passed under direct visualization through the wall of the involved bronchus and moved back and forth within the area to shear off cells, while suction was created by a syringe attached to the proximal end of the needle apparatus. In general, the needle aspiration was performed at two or three sites within the involved area using the same needle. In one pass, the needle was advanced through the bronchus at a shallow, oblique angle to access the submucosal layer, and in another pass it was advanced perpendicular to...
Table 1—Results of TBNA* and FBX† by Cell Type‡

<table>
<thead>
<tr>
<th>Cell type</th>
<th>No.</th>
<th>Positive TBNA</th>
<th>Positive FBX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidermoid</td>
<td>9</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>10</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Small cell</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Large cell</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>7</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

*TBNA = transbronchial needle aspiration.
†FBX = forceps biopsy.
‡All p values for comparisons of TBNA and FBX were greater than .219.

to the bronchial wall to reach the peribronchial tissue. The needle was then pulled out of the area, retracted into its sheath, and withdrawn from the bronchoscope. Once the apparatus was removed from the bronchoscope, the needle was advanced and flushed with 2 ml of a balanced salt solution (Polysal, Cutter Laboratories) and the specimen sent for cytologic processing and examination.

After the needle aspiration, routine forceps biopsy of the area was performed using large (2.2-mm) fenestrated forceps. A minimum of three biopsy specimens was obtained in each case. These specimens were fixed in formalin and processed routinely for pathologic examination. A chest roentgenogram was obtained after the bronchoscopic procedure in all cases.

Analysis

The biopsy specimens were assessed for the presence of carcinoma and a cell type was determined when possible. Cytologic specimens (wash, brush, and transbronchial needle aspiration) were interpreted as positive, suspicious, or negative for malignancy. A cell type was also specified when possible. Specimens reported as suspicious, but not diagnostic, of malignancy, were considered negative for purposes of the analysis.

The statistical significance of differences in proportions of positive results was assessed with the McNemar test.18

Results

All 31 patients had bronchogenic carcinoma. The majority of the tumors were adenocarcinoma (32 percent) or epidermoid carcinoma (29 percent), and the remainder were small cell, large cell, or undifferentiated carcinomas (Table 1). The lesions were fairly evenly distributed among the upper lobe, lower lobe, and mainstem bronchi.

The results of the procedures are listed in Table 2. The needle aspirate was positive in 22 patients (71 percent), and the forceps biopsy was positive in 17 (55 percent). The difference between these yields was not statistically significant (p = .302). Both procedures were positive in only 12 cases (39 percent), however, so the result of either transbronchial needle aspiration or

Table 2—Results of TBNA and FBX in 31 Patients

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No.</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>FBX</td>
<td>17</td>
<td>55*</td>
</tr>
<tr>
<td>TBNA</td>
<td>22</td>
<td>71</td>
</tr>
<tr>
<td>TBNA or FBX</td>
<td>27</td>
<td>87†</td>
</tr>
<tr>
<td>TBNA/FBX/B/W‡</td>
<td>30</td>
<td>97</td>
</tr>
</tbody>
</table>

*p = .302.
†p = .00195.
‡B = Brush; W = Wash.

forceps biopsy was positive in 27 (87 percent). The difference between the yields of the biopsy alone and the biopsy combined with transbronchial needle aspiration was statistically significant (p = .00195). In addition, three of the four cases that were negative on both forceps biopsy and needle aspiration were positive on the brush (two) and wash (one), so that the combination of needle aspiration, forceps biopsy, brush, and wash was positive in 30 (97 percent) cases.

No difference in yield was seen based on tumor cell type (Table 1), location, or the endoscopic appearance of the tumor (Table 3). With respect to the endoscopic findings, the appearance suggested submucosal infiltration by erythema, loss of bronchial markings, or thickening in 13 cases. The needle aspirate was positive in ten and the biopsy in eight (p = .688). The appearance suggested peribronchial disease by bronchial narrowing or extrinsic compression in 12 cases. The needle aspirate was positive in six and the biopsy in seven (p = 1.0). In six cases the appearance was consistent with both submucosal and peribronchial involvement. The aspirate was positive in six and the biopsy in two (p = .125).

No complication occurred with either the needle aspiration or the forceps biopsy. No pneumothorax or pneumomediastinum was noted on the chest roentgenogram, and no significant bleeding occurred with either technique. We did observe, however, that transbronchial needle aspiration generally produced less bleeding than forceps biopsy. Needle aspiration usually produced only a few drops of blood, and at most 2 ml, while forceps biopsy produced as much as 10 to 20 ml.

Discussion

Bronchogenic carcinoma can spread along the mucosal surface, in the submucosal lymphatics, or in peribronchial tissue.13 Mucoosal tumor usually presents as an exophytic mass within a bronchus, while submucosal and peribronchial tumors present more subtly as erythema, loss of normal markings, bronchial narrowing, thickening of the mucosal stripes, or extrinsic compression of the bronchus. Although the diagnostic yield of bronchoscopic forceps biopsy is very high for exophytic masses, submucosal or peribronchial disease is more difficult to detect on standard forceps biopsy.19

Since transbronchial needle aspiration has been a
successful technique for the detection of cancer in mediastinal and hilar nodes" and peripheral masses, we thought it might also be useful in detection of submucosal and peribronchial tumor. Two previous studies have examined the diagnostic yield of needle aspiration in endobronchial lesions. Lundgren obtained 12 positive aspirates in 26 patients with lung cancer, but this result represents a combination of both endobronchial and peripheral lesions. Buirski did not find a statistically significant difference between the yields of needle aspiration and forceps biopsy in 60 patients with endobronchial lesions, but did note that the maximal yield was obtained with a combination of brush, biopsy, and needle aspiration. This study, however, included only seven patients with submucosal or peribronchial tumor as assessed by the endoscopic appearance. Since predominantly mucosal involvement is easily detected by forceps biopsy, we thought it would be of interest to examine the utility of transbronchial needle aspiration specifically in lesions suggestive of submucosal or peribronchial involvement which are more difficult to detect by standard procedures.

We found that, even using the largest available forceps for the fiberoptic bronchoscope, the forceps biopsy detected only 55 percent of the tumors. Transbronchial needle aspiration detected more cases (71 percent), but the difference was not statistically significant. Because the two procedures tended to be positive in different cases, the combination of the two was positive in a significantly greater number of cases (89 percent) than forceps biopsy alone. The ability of the needle to penetrate the mucosal surface and reach the outer bronchial layers apparently contributes to its diagnostic yield. Although the needle aspirate should theoretically have a higher yield than forceps biopsy in peribronchial disease (narrowing or extrinsic compression), we found no difference in the yields of needle aspiration or forceps biopsy based on the endoscopic appearance. In addition to the improved yield obtained with the combination of forceps biopsy and needle aspiration, the wash and brush detected three more cases, bringing the total diagnostic yield to 97 percent. No complications were noted with either procedure, which is consistent with the previous experience with both forceps biopsy and transbronchial needle aspiration.

Based on this experience, we conclude that transbronchial needle aspiration is a safe technique that can significantly increase the diagnostic yield of fiberoptic bronchoscopy in the diagnosis of submucosal or peribronchial spread of bronchogenic carcinoma over that of forceps biopsy alone. To obtain the maximal diagnostic yield, needle aspiration and forceps biopsy should be combined with the standard wash and brush.

REFERENCES
8 Shure D, Astarita RW. Bronchogenic carcinoma presenting as an endobronchial mass: optimal number of biopsy specimens for diagnosis. Chest 1983; 83:865-7
11 Shure D, Fedullo PF. The role of transcarinal needle aspiration in the routine staging of bronchogenic carcinoma. Chest 1984; 86:693-6