Infections Requiring Surgery Following Transbronchial Biopsy in Lung Cancer Patients: A Retrospective Study

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Abstract: To assess the risk factors for severe infections developing as a complication of transbronchial biopsy in lung cancer patients. From April 2001 to March 2007, 1091 patients underwent bronchoscopy at our institution. We reviewed the records of 5 of these patients diagnosed with lung cancer and who developed lung abscess or cavitary infection after transbronchial biopsy necessitating surgical resection. The 5 patients (4 men, 1 woman; mean age at diagnosis, 62.4 years; range, 42–78 years) were all smokers and were immunocompetent. One patient suffered from diabetes mellitus. Of the 5 patients, chest CT revealed a cavitary lesion in 2 patients, central low attenuation in 2 patients, and a small nodule in 1 patient. The longest tumor diameter ranged from 20–60 mm (mean, 42 mm). Sputum cultures taken prior to bronchoscopy showed no significant bacterial growth in 4 of the patients, with 1 patient showing Streptococcus pneumoniae. Three cases showed elevated serum C-reactive protein. Histologically, the diagnosis was squamous cell carcinoma in 3 patients and adenocarcinoma in 2 patients. The risk factors for the development of a lung abscess after transbronchial biopsy include large mass lesions with central necrosis or cavitary lesions.

Key words: severe infection, complication, transbronchial biopsy, lung cancer

Introduction

Bronchoscopy is a relatively simple and well-tolerated procedure that can provide diagnostic benefits. However, serious complications such as arrhythmia, bleeding, bronchospasm, and pneumothorax may occur¹⁴. Severe lung infection complicating transbronchial biopsy also occurs rarely, and care must be taken during bronchoscopic biopsies in lung cancer patients because lung cancer itself is a risk factor for lung infection⁵.

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This study sought to determine the factors that may place lung cancer patients at an increased risk of developing severe infection after bronchoscopic examination.

**Material and Methods**

From April 2001 to March 2007, 1091 patients underwent bronchoscopy at our institution, 473 of these patients undergoing transbronchial biopsy of the peripheral tumor under fluoroscopy. Radiological findings in these 473 tumors revealed a homogeneous solid lesion in 387 cases, a solid lesion with central necrosis in 52, and cavitary lesions in 33 patients.

We reviewed the records of five patients with lung cancer who developed lung abscess or cavitary infection requiring surgical resection after transbronchial biopsy. All examinations were performed at the outpatient clinic using an Olympus BF 240 bronchoscope, which was introduced through the mouth with the patient under light sedation induced with intravenous midazolam. The examiner wore a mask and gloves for the procedure. After premedication with 0.5 mg of atropine administered by intramuscular injection, local anesthesia was induced by topical application of 2 percent xylocaine directly onto the vocal cords and as needed on the bronchial mucosa. Oxygen therapy and/or ECG monitoring were employed only when clinically indicated. Apparent endobronchial lesions were biopsied, with peripheral lesions biopsied or curetted under fluoroscopic control. After each procedure, the bronchoscope was cleaned by wiping the outer sheath and lavage of the inner channel with copious amounts of water using a turbulent interrupted flow, followed by 70% alcohol.

Categorical data were compared by χ² test analysis using the Social Science (SPSS) for Windows statistical software package.

**Results**

During this study, 6 patients developed pneumonia as a complication of the fiberoptic bronchoscopy. Of these patients, 5 had lung cancer, and 1 had bronchial atresia of the right upper lobe bronchus. The 5 patients with lung cancer (4 men, 1 woman; mean age at diagnosis of 62.4 years; range, 42–78 years) were all smokers and were immunocompetent; 1 of these patients also had diabetes mellitus. Three patients showed elevated serum C-reactive protein, of which one had received antibiotics before the bronchoscopy. Chest computed tomography revealed a cavitary lesion (Fig. 1) in 2 of the 5 patients with lung cancer, central low attenuation (Fig. 2) in 2 patients, and a small nodule in 1 patient. The tumor diameters at the widest points ranged from 20–60 mm (mean, 42 mm). The patients showing cavitary lesions or central necrosis also had increased incidence of complicating severe lung infection compared with the patients showing homogeneous solid tumors (Table 1). There were no endobronchial lesions visualized, and peripheral lesions were biopsied under fluoroscopic control. The pathological diagnosis was squamous cell carcinoma in 3 patients and adenocarcinoma in the remaining 2 patients.

The intervals between bronchoscopic examination and admission for pneumonia ranged...
Table 1. Comparison between CT findings of lung tumor and complication of severe infection after transbronchoscopic biopsy

<table>
<thead>
<tr>
<th>Patients, n = 476</th>
<th>Complication of severe infection</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>occurrence</td>
<td>none</td>
</tr>
<tr>
<td>CT findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid (homogeneous)</td>
<td>1 (0.3%)</td>
<td>387 (99.7%)</td>
</tr>
<tr>
<td>Cavitation or Central necrosis</td>
<td>4 (4.5%)</td>
<td>84 (95.5%)</td>
</tr>
</tbody>
</table>

Fig. 1. Central necrosis (Case 2)

Fig. 2. Cavitary lesion (Case 4)
from 7 to 21 days (mean, 12 days). Three patients showed clinical improvement after treatment with antibiotics, although the enlarged cavity of the tumor remained, while one patient developed emphysema, and the remaining case developed an abscess in the tumor. Four patients underwent lobectomy and one patient underwent bilobectomy. The tumors were completely resected in 4 patients, with 1 patient showing deep tumor invasion of the apical pleura. The results of pathological staging revealed stage I in two patients, stage II in 1 patient, and stage III in 2 patients (Table 2). The postoperative course was uneventful in all patients.

Table 3 details the results of bacteriological analyses of sputum samples obtained prior to the bronchoscopic examination, bronchial lavage specimens, and surgical specimens. Sputum samples taken prior to bronchoscopy were negative for significant bacterial growth in 4 of the 5 patients; the remaining patient sputum was positive for *Streptococcus pneumoniae*. Pathogenic bacteria were isolated from the surgical specimens of 3 patients, whereas the bronchial lavage fluid specimens showed normal pharyngeal flora in all cases.

**Discussion**

The flexible fiberoptic bronchoscope has gained wide acceptance since its introduction by Ikeda in 1970. A number of retrospective studies have reported low incidences of major complications following flexible fiberoptic bronchoscopic procedures such as cardiac arrest,
respiratory compromise, pneumothorax, hemorrhage, pneumonia, and bacteremia\textsuperscript{1-4}. Credle \textit{et al}\textsuperscript{1} surveyed the complications of fiberoptic bronchoscopy by questionnaire to reveal 22 major complications (0.08\%) and 3 deaths (0.01\%) among 24,521 procedures included in the survey. Pereira \textit{et al}\textsuperscript{2} prospectively analyzed 908 bronchoscopic procedures and found 13 major complications (1.7\%) and 1 death (0.1\%).

Severe lung infection complicating transbronchial biopsy is also rare. Of the 24,521 procedures surveyed by Credle \textit{et al}\textsuperscript{1}, only 8 patients had fever, and 2 patients developed pneumonia. On the other hand, the study of 100 patients undergoing fiberoptic bronchoscopy by Pereira \textit{et al}\textsuperscript{2} revealed 9 patients with fever, and 6 patients exhibiting fever plus a pulmonary infiltrate. In a later study, the same group re-examined the type of complications after bronchoscopy, and reported that pneumonia developed as a complication in 5 of the 908 patients (0.6\%)\textsuperscript{5}.

Factors predisposing to severe lung infection as a postbronchoscopy complication could be divided into those related to host susceptibility and those related to the procedure. Host risk factors include a general predisposition to infection and impairment of the local immune defense mechanisms caused by lung cancer and cigarette smoking. Procedure-related factors would include direct trauma to the bronchial mucosa, impaired local defense mechanisms resulting from depression of the cough reflex as a result of topical anesthesia, and the introduction of potential pathogens into the lower respiratory tract by the fiberoptic bronchoscope\textsuperscript{5}.

This study assumed that lung cancer was the major contributing factor, as 5 of the 6 patients with lung infection occurring as a postbronchoscopy complication in this study were diagnosed with lung cancer. Moreover, we found that important risk factors for the development of severe infection after transbronchial biopsy were the presence of a large mass with central necrosis or cavitary lesions and a positive C-reactive protein. Caution must therefore be exercised during bronchoscopic biopsy in lung cancer patients with these risk factors.

The development of severe infection relates to direct trauma of the lung parenchyma or tumor tissue after biopsy, with the causative bacteria being organisms normally resident in the airways. The introduction of potential pathogens into the lower respiratory tract by the bronchoscope does not appear to play a major role, based on only one case in the present study where the organisms isolated from the surgical specimen corresponded to the organisms isolated from the upper respiratory tract. No evidence currently indicates the use of prophylactic antibiotics in any group of patients undergoing fiberoptic bronchoscopy. One case was reported in which prophylactic antibiotic treatment did not prevent sepsis after fiberoptic bronchoscopy\textsuperscript{7}, and in that study also, one patient developed a lung abscess in spite of antibiotics being administered before the bronchoscopic examination. In a large survey conducted by the Japan Society for Bronchology in 2002, antibiotics were administered prophylactically before fiberoptic bronchoscopy by 49\% of the institute members\textsuperscript{8}.
In conclusion, this study indicates consideration of prophylactic antibiotic administration before and after bronchoscopy to minimize the risk of severe lung infection after transbronchial biopsy. Large-scale studies will be needed in patients with lung cancer to estimate the efficacy of prophylactic antibiotics before bronchoscopy.

References


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