Diagnosis and Management of Endobronchial Tuberculosis

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We examined the records of sixty-one patients (17 males and 44 females) with endobronchial tuberculosis (EBTB). Smear tests of acid-fast bacilli were positive in 42 cases and cultures of tubercle bacilli (TB) were positive in 57. The main findings of chest roentgenogram on admission were as follows: no abnormal findings in 8, atelectasis in 30, infiltration in 25, and cavitary lesions in 6. The localization and cross-sectional extension of lesions confirmed bronchoscopically were as follows: trachea in 15, with 3 circular lesions (CLs). Right (R-) main bronchus in 19 with 11 CLs, left (L-) main bronchus in 18 with 11 of CLs, R-truncus intermedius in 14 with 6 of CLs, R-upper lobar bronchus (UB) in 17 with 12 CLs, R-middle lobar bronchus in 14 with 11 of CLs, R-lower lobar bronchus (LB) in 6 with 2 CLs, L-UB in 10 with 7 CLs and L-LB in 3 with 2 CLs. All cases were treated by combination chemotherapy with isoniazid, rifampicin, streptomycin and/or ethambutol and the rate of negative conversion of TB was good, but most of circular lesions resulted in severe bronchial stenosis or complete obstruction during and after chemotherapy, and no improvement was seen in any of the atelectasis cases at the cessation of chemotherapy. We discuss the points of early diagnosis and management of EBTB.

Key words: persistent cough attack, positive of tubercle bacilli, bronchial stenosis and obstruction, antituberculous chemotherapy, atelectasis

Introduction

Decrease of active tuberculosis, which was once remarkable, has recently slowed down; in recent years, more than 25,000 patients with infectious tuberculosis have been newly registered every year (1). Tuberculosis is still one of the common respiratory infections in Japan. Recently, bronchoscopy is routinely used for diagnosis and treatment of various respiratory diseases and disorders, and is also effectively applicable to the diagnosis of pulmonary tuberculosis. This routine use of bronchoscopy has revealed a fair number of cases of endobronchial tuberculosis (EBTB) and revealed its potential existence (2, 3), although the number of newly diagnosed patients with active tuberculosis has decreased.

Patients with active EBTB discharge a high rate of tubercle bacilli (TB), and hence early diagnosis and treatment is essential from the viewpoints of both social and clinical medicine to prevent infection of TB and various complications accompanied by bronchial stenosis and/or complete obstructions due to fibrous cicatization of lesions. We studied the records of patients of EBTB and discuss here some points for early diagnosis and management.

Subjects and Methods

During eleven years from 1980 to 1990, there were sixty-one cases including 17 males and 44 females, who had tuberculous lesions in the trachea and major bronchi as indicated by bronchoscopy. The age of the patients ranged from twenty to eighty-four, and elderly patients were not uncommon. Ten cases had a history of tuberculosis. Anamneses or complications, which might have influenced the onset of tuberculosis, were found in eleven cases: there were 3 cases of diabetes mellitus (DM); one case of DM + gastrectomy, one case of hysterectomy (uterus cancer); and one case of bronchial asthma. No anamnesis and complication were found in the other 43 cases (Table 1).
Results

1) Onset to final diagnosis

Symptoms at the onset were as follows: cough in 82%, sputum in 41%, fever in 28%, and wheezing in 10%, while the symptoms on admission worsened to include 85% cough, 61% sputum, 36% fever, and 30% wheezing. Furthermore, such symptoms reflecting the progressive pathema increased as 15% malaise, 13% chest discomfort, and 11% hoarseness (Fig. 1). In the cases who had a longer time interval from onset to admission, the symptoms showed more remarkable worstenting. The time interval from onset to admission was less than 3 months in 26 cases (43%) and more than 3 months in 35 cases (57%). The patient's delay (time interval from onset to first consultation) was as follows: less than 1 month in 46 cases (75%), less than 3 months in 8 (14%), and more than 3 months in 7 (11%). On the other hand, the doctor's delay (time interval from first consultation to final diagnosis) was as follows: less than 1 month in 21 cases (34%), less than 3 months in 31 cases (51%), and more than 3 months in 9 cases (14%). Diagnoses at the first consultation were as follows: pulmonary tuberculosis in 19 cases (31%), pneumonia in 14 cases (23%), lung cancer in 11 cases (18%), bronchitis in 10 cases (16%) and asthma in 3 cases (5%), except for 4 unknown cases (Fig. 2). Most of patients diagnosed as pulmonary tuberculosis had already been treated the anti-tuberculous chemotherapy before the final diagnosis and most of those diagnosed as lung cancer or pneumonia at the first consultation were diagnosed as bronchial diagnosis by bronchoscopy without delay after the admission. Many of the patients diagnosed as bronchitis or asthma, however, did not have any remarkable findings on chest roentgenogram, rather a long time was required until a final diagnosis was made: meanwhile in some cases, the disease worsened. These results show the importance of early and correct diagnosis.

2) Findings of clinical examinations and chest roentgenogram

Clinical examination revealed a high positive rate (69%) of smear test for acid-fast bacilli through sputum or bronchoscopic aspirates and that of positive PPD skin reaction (moderate or severe). However, results of leukocyte or lymphocyte counts of peripheral blood, erythrocyte sedimentation rate, CRP and other inflammatory findings and total protein and albumin in peripheral blood varied widely from normal range to severe abnormal findings, reflected by a variety of complications and severity of pulmonary tuberculosis (Table 2). Even some patients had normal values for all these

Fig. 1. Symptoms at onset and admission.

Fig. 2. Delay and diagnosis at first consultation.
Endobronchial Tuberculosis

Table 2. Laboratory Findings on Admission

<table>
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<tr>
<th>PPDs</th>
<th>Tuberculous bacilli</th>
<th>BSR (mm/h)</th>
<th>CRP (×10^9/mm^3)</th>
<th>WBC (×10^9/mm^3)</th>
<th>Lymphocyte (×10^9/mm^3)</th>
<th>Total protein (g/dl)</th>
<th>Serum albumin</th>
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<td>39</td>
<td>37</td>
<td>54</td>
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<td>46</td>
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<tr>
<td>±</td>
<td>Smear culture</td>
<td>21 50 -</td>
<td>+</td>
<td>50 80</td>
<td>11 25</td>
<td>6.5 8.0</td>
<td>3.0 4.0</td>
</tr>
<tr>
<td>+</td>
<td></td>
<td>20 49 ±</td>
<td></td>
<td>49 79</td>
<td>10 25</td>
<td>6.4 8.0</td>
<td>2.9 4.0</td>
</tr>
<tr>
<td>Results cases</td>
<td>43</td>
<td>0</td>
<td>42 19 57 4</td>
<td>4 14 21</td>
<td>14 12 11</td>
<td>9 38 7</td>
<td>10 40 3</td>
</tr>
</tbody>
</table>

Table 3. Findings of Plain Chest Roentgenograms on Admission (n = 61)

| No active lesion | 8 (13%) |
| Atelectasis | 30 (49%) |
| Pulmonary infiltrates | 25 (41%) |
| Hilar enlargement | 7 (11%) |
| Cavitary lesion (s) | 6 (10%) |
| Mediastinal deviation | 4 (7%) |
| Pleural effusion | 2 (3%) |
| Mass lesion | 1 (2%) |

Location of Atelectasis (n = 30)

| Right upper lobe | 8 (27%) |
| Right upper segment | 1 (3%) |
| Right middle lobe | 14 (47%) |
| Right lower lobe | 4 (13%) |
| Left upper lobe | 1 (3%) |
| Left upper segment (s) | 1 (3%) |
| Lingula | 1 (3%) |
| Left lower lobe | 2 (7%) |

Fig. 3. First bronchoscopic findings.

bronchus) lesions are shown by the solid line, and continuous, circumscribed (spreading less than two thirds of cross section of bronchus) lesions by the dotted line. The closed circles denote localized, circular lesions, and the open circles denote localized, circumscribed lesions. The localization of lesions and number with circular lesions confirmed by bronchoscopy were as follows respectively: trachea in 15 cases and 3 cases, right (r-) main bronchus (Br.) in 19 and 6, left (l-) main Br. in 18 and 11, r-truncus intermedius in 14 and 6, r-upper lobar Br. in 17 and 12, r-middle lobar Br. in 14 and 11, right lower lobar Br. in 6 and 2, l-upper lobar Br. in 10 and 7, and l-lower lobar Br. in 3 and 2. Main bronchoscopic findings of active lesions were granulomatous, ulcerative lesions covered by white-yellow necrotic tissue; these were often accompanied by severe hyperemia and swelling of mucosa. The longer the time interval from the onset was, more central the airway and the wider the cross-section of bronchus the lesions extended. These results also suggest the importance of early diagnosis.

4) Treatment and outcome of lesions

All patients were treated by chemotherapy combined with three or four regimen of isoniazid (INH), rifampicin (RFP), streptomycin (SM) and ethambutol (EB). The effects of treatment were traced for 56 cases of positive tubercle bacilli (TB) except for one death case and one untraceable case due to change of hospital. Except for

3) Localization and width of lesions

Figure 3 shows first bronchoscopic findings in connection with chemotherapy and time interval from onset. As seen in Fig. 3, there were continuous and local lesions spreading along the bronchial mucosa. Continuous, circular (spreading over two thirds of cross section of laboratory tests.

Main findings of chest roentgenogram on admission were as follows (Table 3): atelectasis in 30 cases (49%), infiltrates of various width in 25 (41%), hilar enlargement in 7 (11%) and cavitary lesion in 6 (10%), while eight cases did not have any active lesions (Table 2). The locations of atelectasis were right middle lobe in 14 cases, right upper lobe in 8, right lower lobe in 4, left upper lobe in 1, and left lower lobe in 2 cases. Lobar atelectasis was mainly found in the right lung and there were a fair number of sites of tuberculosis of right middle or left and right lower lobes, which are different from the common sites of secondary pulmonary tuberculosis.
one case who was intermittently positive of TB for five months, all cases became negative to TB within two months after beginning of chemotherapy. No TB manifested in vitro resistance to these regimens. Among the findings of chest roentgenogram after the beginning of chemotherapy, active pulmonary lesions such as infiltrates and cavities were improved and cured, whereas atelectasis was not improved in any cases at the time of cessation of chemotherapy, although transient improvement was observed in some cases. Most of circumscribed lesions on first bronchoscopy were cured without sequelae, but in most circular lesions, severe bronchial stenosis or complete obstruction was observed at the cessation of chemotherapy, and in some cases, bronchial stenosis gradually progressed even after cessation of chemotherapy. Among three cases with circular lesions of the trachea, one cases suddenly died of suffocation on the 34th hospital day, and another case gradually showed progressive wheezing and dyspnea and so, tracheotomy and tracheoplasty were carried out two months after the start of chemotherapy to secure the airway, and excision of the whole right lung due to total collapse and tracheoplasty with exeresis of trachea by 5 cm were carried out finally fifteen months after the start of chemotherapy.

Four cases with negative TB had lobar atelectasis and first had the operation of lobectomy. They were further treated by chemotherapy after operation, since bacteriological and/or histopathological studies revealed the presence of active lesions.

Discussion

The possible mechanism of onset of endobronchial tuberculosis (EBTB) includes, 1) direct infection of the bronchial mucosa, 2) continuous infiltration of pulmonary lesions, 3) perforation of lymph nodes surrounding bronchus, 4) hematogeneous spread (4). We had some cases thought to have been triggered by one of the mechanisms (1) through (3), but no case of EBTB was accompanied by miliary tuberculosis. In recent English language papers, lesions by mechanism (1) or (2) are distinguishable from those by mechanism (3). The former is called “endobronchial tuberculosis”, while the latter is called “tuberculosis bronchitis”. There are some differences in the methods of management between these two types, however, bronchoscopically, it is not always easy to make a distinction between these two except for some cases with specific findings of perforation of a lymph node. Chemotherapy is essentially necessary to treat both types of lesions. Thus, both types were included in this study.

The rate of EBTB occurring as a complication of respiratory tuberculosis had been reported to be about forty to eighty percent by necropsy cases and ten to thirty percent by broncoscopy cases at pre-chemotherapeutic era (5–8). According to recent reports (2, 3, 9–11), however, there are several percent for male and approximately fifteen percent for female (8–10). Among the 112 patients admitted to our hospital with active respiratory tuberculosis during seven and a half years until October, 1985, there were three male cases (4.1%) and fourteen female cases (35.9%) with active EBTB (12). Many recent studies reported that the number of female cases was two to three times greater than that of males (2, 3, 9–11). Since the rate of males to females with pulmonary tuberculosis is approximately 2 to 1, females certainly have a higher susceptibility for EBTB than males. The difference may be possibly due to the thinner caliber of female bronchi or tendency of retention of the secretion in the airway of females, but the cause has not been clearly specified. On the other hand, the rate of males to females for lymphadenitis coli tuberculosis is also about 1 to 2 (13). When EBTB is regarded as tuberculosis of the lymphoid tissue around the trachea and bronchus, the rate agrees well with that of lymphadenitis coli tuberculosis. Neither the cause of sex difference in lymphadenitis coli tuberculosis nor the reason that so many cases are complicated by both disorders of EBTB and lymphadenitis coli tuberculosis has been specified.

The main subjective symptoms of EBTB given in a classic textbook on tuberculosis (14) are as follows: 1) persistent cough attack: 2) viscous sputum which is not easily expecterated: 3) wheezing, and 4) discomfort under sternal area. It is also said that those with positive TB, bloody sputum and hemoptysis, which could not be explained by findings of chest roentgenograms, might be due to EBTB. Except for a positive TB, these symptoms are not peculiar to EBTB but are generally observed in various respiratory diseases. Symptoms such as wheezing and discomfort under the sternal area are due to stenosis of the brachea and major bronchi as the advanced stage of this disorder, and are not useful for early diagnosis. As clearly seen in Fig. 1, subjective symptoms of EBTB at onset and admission were 82% and 85% cough, 41% and 61% sputum, 28% and 36% fever, and 10% and 30% wheezing, respectively, as well as chest discomfort, hoarseness, bloody sputum, and malaise. Most of the patients with a longer time interval from onset to admission had severe and progressive symptoms such as wheezing and chest discomfort. In Arai’s report of 113 cases (9), there were 63% cough and sputum, 32% fever, 14% bloody sputum, and 9% wheezing. The most common subjective symptom at onset of EBTB was persistent cough attack reflecting the stimulus to bronchial mucosa with or without a small amount of sputum which was not easily expecterated. These findings are useful for early diagnosis of EBTB and differential diagnosis from so called “chronic bronchitis”. As the lesions of the airway progress more widely and centrally, such symptoms as sputum and fever reflected by inflammation of lung parenchyma, bloody sputum and
hemoptysis due to ulceration of the lesions, and wheezing and dyspnea due to stenosis and/or complete obstruction of trachea and major bronchi may appear gradually.

In the main findings of chest roentgenogram at diagnosis, Komatsu et al (10) reported that there were 28% atelectasis, 33% infiltrates, 8% hilar lymphadenopathy, and 33% no active lesions out of forty cases. Arai (9) reported 35% atelectasis, 29% infiltrates of various width (17% minimum infiltrates), and 21% no active lesions; no remarkable findings in the lung fields were detectable in 40% of all cases, including two cases with hilar lymphadenopathy. In the present 61 cases, there were eight cases (13%) of no active lesions, thirty-one cases (49%) of atelectasis, and twenty-five cases (41%) of infiltrates of various width. The locations of atelectasis were as follows: right upper lobe in eight (27%), right middle lobe in fifteen (48%), right lower lobe in four (13%), left upper lobe in three (3%), and left lower lobe in two (7%). Less than half cases revealed pulmonary lesions of tuberculosis, atelectasis due to bronchial stenosis or complete obstruction was observed in more than one-third of the cases, whereas no active lesion could not be detected in the lung fields on plain chest roentgenogram in eight cases and “lower lung field tuberculosis” was not uncommon. Tanaka et al (11) reported that stenosis of the airway was detected in twenty-three out of twenty-five cases on chest roentgenograms including tomogram. Minute reading of air column of trachea and major bronchi of chest roentgenograms including the tomogram is essential for early detection of stenotic changes of central airways including central origin of lung cancer.

The results of laboratory findings did not reveal any specific findings except for a high rate of positive smear for acid-fast bacilli and that of PPD skin test (almost more than moderate rection). Findings reflecting infection and inflammation vary from normal to abnormal values depending on the existence of and severity of complications or pulmonary lesions. Detection of TB from various materials such as sputum and aspirate via bronchoscopy is essential in diagnosing tuberculosis. Thus, in principle, it is necessary to detect TB from various materials by smear and culture tests for acid-fast bacilli.

There was no significant difference in the location of lesions between right and left bronchi. Most common sites of lesions were trachea, right and left main bronchus, right and left upper lobar bronchus, right truncus intermedius, and right middle lobar bronchus. Main bronchoscopic findings of EBTB (15) include: active lesions such as 1) severe hyperemia and swelling of mucosa; 2) submucosal nodular proliferation; 3) nodal projection; 4) ulceration; 5) pseudomembranous necrotic tissue covering these lesions, which can not be easily peeled off; 6) indirect findings such as widening of carina and stenosis of bronchial lumen due to extramural lymphadenopathy; and curative lesion such as 7) flat or concentric stenosis or obstruction due to fibrous cicatrization. More than one of these findings in combination are observed locally or continuously through airways with various cross-sectional extensions of bronchus. Since there are some lesions which may be difficult to distinguish from lung cancer, biopsy of lesions via bronchoscopy should be performed with tests of TB.

Active EBTB is generally treated by combination chemotherapy like in pulmonary tuberculosis. Combination chemotherapy including INH and RFP gives excellent results of negative inversion of TB and cure of bronchial lesions as pulmonary lesions (2, 3, 9-11, 16). We treated fifty-six cases by combination of three to four regimens of INH, RFP, EB, and SM, and all the cases achieved a negative TB culture within three consecutive months after the start of chemotherapy, except for one case whose positive culture of TB continued intermittently for five months. The lesions showed gradual improvement and the circumscribed lesions were almost cured without any sequella, but most of the circular lesions became more stenotic and obstructive with fibrous cicatrization as cure mechanism of lesions. No improvement of atelectasis in thirty cases was found at the cessation of chemotherapy, and in some patients, symptoms such as wheezing and dyspnea on effort worsened gradually during chemotherapy and also after the cessation of chemotherapy. Four of five cases, who had cicatrical stenosis of major bronchi as revealed by operation, complained of such symptoms as wheeze and dyspnea, which showed gradual worsening after the cessation of chemotherapy against pulmonary tuberculosis.

One out of three cases with circular lesions of trachea suddenly died by suffocation on the 34th hospital day and another case with progressive dyspnea needed tracheotomy to maintain the airway two months after admission.

Regarding EBTB, early diagnosis is essential to prevent these sequellae and proper management including surgical treatment is desirable according to the severity of the disease (16). Except for urgent operation, the surgical treatment should be carried out after chemotherapy of more than six months.

**References**


