Bronchoscopic and Angiographic Comparison of Bronchial Arterial Lesions in Patients with Hemoptysis*

Osamu Katoh, M.D.; Hozumi Yamada, M.D.; Kenya Hiura, M.D.; Yoichi Nakanishi, M.D.; and Takashi Kishikawa, M.D.

In seven patients with nonmalignant disease, we bronchoscopically observed various types of bronchial arterial lesions that may have caused hemorrhage. Five of the seven showed a bulging lesion, and the other two demonstrated an intrabronchial mass. We also examined these seven patients using selective bronchial arteriography. Herein we report our comparative study of the bronchoscopic findings and the bronchial arteriograms of these bronchial arterial lesions. The bulge observed in bronchoscopy corresponded either to an aneurysm or to a hypervascular area in the bronchial arteriogram. The mass lesions corresponded to a hypervascular area or a focal dilatation in the bronchial arteriogram. The intrabronchial lesions observed bronchoscopically either disappeared or were significantly diminished by bronchial arterial embolization for management of the hemorrhage. A histologic examination in two patients who underwent surgery revealed vascular lesions corresponding to the intrabronchial lesions in bronchoscopy. The results of this comparative study have important application in the bronchoscopic examination of bronchial arterial lesions in patients with hemoptysis.

Hemoptysis is a relatively common event in pulmonary disease. It is considered to be derived from increased bronchial circulation. Various bronchial arterial lesions have been demonstrated by angiography in patients with hemoptysis; however, very few reports have dealt with a bronchoscopic and angiographic evaluation of the bronchial arterial lesions.

Herein we report a comparative study of bronchoscopic findings with angiograms of bronchial arterial lesions in patients with hemoptysis.

Materials and Methods

From May 1984 to April 1986, a total of 582 patients, including 58 patients with hemoptysis, underwent fiberoptic bronchoscopy at Saga Medical School. Twenty-eight patients with hemoptysis suffered from cancer of the lung, and another 30 patients had hemoptysis caused by nonmalignant diseases. Seven (four men and three women; age range, 39 to 69 years) of the 30 patients with nonmalignant disease demonstrated bronchial arterial lesions on bronchoscopy. In these seven patients, the underlying diseases were bronchiectasis (patients 2 and 3), chronic bronchitis (patients 4 and 7), old tuberculosis with thoracoplasty (patient 1), and atypical mycobacterial infection (patient 5); only one patient (No 6) had no complication or underlying disease. The extent of hemorrhage in a 24-hour period exceeded 1,000 ml in patient 1, was 200 to 300 ml in patients 2, 6, and 7, and was 50 to 150 ml in patients 3 to 5.

A bronchoscopic examination was performed either during bleeding or within 24 hours after disappearance of bleeding. A fiberoptic bronchoscope (Olympus BFIT-10 [5.9 mm in diameter] or Olympus B3C [3.4 mm in diameter]) was used. The latter visualized nearly the seventh-order bronchi.

Selective bronchial arteriography was carried out to detect the hypervascular lesions in all patients. It was done by percutaneous catheterization via the femoral artery, and at the same time, bronchial arterial embolization was done with Ivaron particles or steel coils (or both) for management of the hemorrhage.

Patients 5 and 6 received lobectomy or segmentectomy because of recurrent bleeding. In both patients pathologic examination was undertaken to identify the bronchial arterial lesions.

Results

Bronchoscopic Findings

The various types of bronchial arterial lesions were observed by bronchoscopy in seven patients with hemoptysis (Table 1). These vascular lesions were located in the second-order to the fifth-order bronchi and were divided into two types, bulge or mass type.

Bulge lesions were found in patients 1 to 5. In patient 1, there was a reddish round bulge 3 mm in diameter, demonstrating a thin wall and prominent pulsation (Fig 1A). The bulge was located at the membranous portion of the right posterior basal bronchus (B3). The lesion did not appear to be covered with normal bronchial mucosa. In patient 2, there was a bulge arising from the membranous portion of the left anteromedial basal bronchus (B3), and this was covered with normal bronchial mucosa. In patients 3 to 5, there were pulsating bulges at the membranous portion or the intercartilaginous sites of the second-order to the fourth-order bronchi. These were covered with normal bronchial mucosa.

Mass lesions were found in patients 6 and 7. In patient 6, there was an intrabronchial mass occupying more than 90 percent of the fifth-order bronchus in the right upper lobe (Fig 2A). The mass was about 2 mm in diameter, and its surface was lobulated. In patient 7,
there was a reddish polypoid mass 1 mm in diameter arising from the intercartilaginous site of a fifth-order bronchus in the left lower lobe.

**Bronchial Arteriograms**

Bronchial arteriographic findings in seven patients are shown in Table 1. Hypervascularity and dilatation of the bronchial artery were found in all patients. Five of the seven patients showed bronchopulmonary anastomosis. A bronchial aneurysm was found in one patient.

In patient 1, prominent hypervascularity, marked dilatation, and bronchopulmonary anastomosis were seen in the bronchial arteriogram (Fig 1B). An aneurysm was at the site corresponding to that of the bulge observed on bronchoscopy. In patient 2, prominent hypervascularity, marked dilatation, and bronchopulmonary anastomosis were seen, and the bulge observed in bronchoscopy corresponded to the area of hypervascularity. Bronchial arteriograms in patients 3 to 5 demonstrated prominent or moderate hypervascularity, mild or moderate dilatation, or bronchopulmonary anastomosis. The bulge lesions in bronchoscopy corresponded to the hypervascular areas.

In patient 6, an obstruction of the bronchial artery with a focal dilatation was noted, although other vascular changes were minimal (Fig 2B). The intrabronchial mass during bronchoscopy corresponded to the focal dilatation of the bronchial artery. In patient 7, the bronchial arteriogram showed prominent hypervascularity, moderate dilatation, and bronchopulmonary anastomosis. The polypoid lesion corresponded to an area of hypervascularity in the bronchial arteriogram.

All seven patients were treated with bronchial arterial embolization for management of the hemorrhage, which resulted in complete disappearance of hemorrhage in five patients. After embolization, bronchoscopy revealed disappearance or diminution of the
Table 1—Bronchoscopic and Angiographic Findings in Seven Patients with Hemoptysis

<table>
<thead>
<tr>
<th>Patient</th>
<th>Disease</th>
<th>Volume, ml</th>
<th>Location</th>
<th>Bronchoscopic Findings</th>
<th>Angiographic Findings</th>
<th>Treatment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Old tuberculosis with thoracoplasty</td>
<td>1,000</td>
<td>Right B³</td>
<td>Bulge</td>
<td>Prominent hypervascularity; marked dilatation; bronchopulmonary anastomosis; aneurysm</td>
<td>BAE</td>
</tr>
<tr>
<td>2</td>
<td>Bronchiectasis</td>
<td>300</td>
<td>Left B⁴</td>
<td>Bulge</td>
<td>Prominent hypervascularity; marked dilatation; bronchopulmonary anastomosis</td>
<td>BAE</td>
</tr>
<tr>
<td>3</td>
<td>Bronchiectasis</td>
<td>100</td>
<td>Right B¹⁰</td>
<td>Bulge</td>
<td>Prominent hypervascularity; moderate dilatation; bronchopulmonary anastomosis</td>
<td>BAE</td>
</tr>
<tr>
<td>4</td>
<td>Chronic bronchitis</td>
<td>50</td>
<td>Right B⁴</td>
<td>Bulge</td>
<td>Moderate hypervascularity; mild dilatation</td>
<td>BAE</td>
</tr>
<tr>
<td>5</td>
<td>Atypical mycobacterial infection</td>
<td>150</td>
<td>Right B¹⁰</td>
<td>Bulge</td>
<td>Moderate hypervascularity; mild dilatation; bronchopulmonary anastomosis</td>
<td>BAE; lobectomy</td>
</tr>
<tr>
<td>6</td>
<td>None</td>
<td>200</td>
<td>Right B³</td>
<td>Mass</td>
<td>Obstruction with focal dilatation</td>
<td>BAE; segmentectomy</td>
</tr>
<tr>
<td>7</td>
<td>Chronic bronchitis</td>
<td>300</td>
<td>Left B⁴</td>
<td>Mass</td>
<td>Prominent hypervascularity; moderate dilatation; bronchopulmonary anastomosis</td>
<td>BAE</td>
</tr>
</tbody>
</table>

*BAE, Bronchial arterial embolization.
†Denotes correspondence to bronchoscopic findings.

intrabronchial lesions observed before treatment.

Figures 1C and 2C demonstrated a diminished intrabronchial lesion in patients 1 and 6, respectively; however, the other two patients (patients 5 and 6) received lobectomy or segmentectomy for recurrent hemorrhage.

**DISCUSSION**

Angiography produces much information about the vascular disturbance causing hemorrhage. Ishihara et al⁷ performed selective bronchial arteriography in 122 patients with nonmalignant pulmonary diseases, and they found hypervascularity in 115 patients and bronchopulmonary anastomosis in 45 patients. Ferris⁸ also used bronchial arteriography in 25 patients who had massive pulmonary hemorrhage, and he suggested the possibility of the hemorrhage being from the bronchial arterial lesion. A bronchial arterial aneurysm was detected using bronchial arteriography by Hall et al⁹ and by Abet and Pietri.⁴ Unfortunately, these investigators⁴⁎ did not include any detailed bronchoscopic findings.

We have found that there are two types of bronchial arterial lesions in patients with hemoptysis, and we have performed a comparative study of the bronchoscopic findings with the angiograms of each of seven lesions. An intrabronchial bulge was discovered by bronchoscopy in five patients (patients 1 to 5). In patient 1, the bulge corresponded to the site of an aneurysm in the bronchial arteriogram. We managed to directly observe an aneurysm, as a bulge with a reddish thin wall and prominent pulsation. In the other four patients the bulge corresponded to the site of hypervascularity in the bronchial arteriograms. In these patients, prominent or moderate hypervascularity and marked or moderate dilatation were present. We suppose these lesions to be similar to the angiomatic vascular convolutions reported by Cain and Spanel,⁵ who performed histopathologic examinations on the bronchial circulatory system.

An intrabronchial mass was discovered in two patients. In patient 6, this lesion corresponded to the focal dilatation with obstruction observed in the bronchial arteriogram. The resected specimen showed that this obstruction was due to focal scar formation. The dilated bronchial artery appeared similar to a tumor. The mass lesion observed bronchoscopically in patient 7 corresponded to the hypervascular area in the bronchial arteriogram.

The intrabronchial lesions observed in bronchoscopy may have contributed to the bronchial arterial lesions. These intrabronchial lesions disappeared or diminished in size after bronchial arterial embolization, and the pathologic examination in two patients who underwent surgery revealed vascular changes at the site of the intrabronchial lesions.

It is important to note that some bronchial arterial lesions showed bronchoscopic findings similar to those of a tumor. Consequently, a fatal hemorrhage may be complicated if such vascular lesions were injured during bronchoscopic biopsy and brushing. Takeuchi et al⁶ and Flick et al⁷ have reported massive and fatal hemorrhage from such an intrabronchial vascular lesion injured during bronchoscopic biopsy.

These implications of the correspondence between the bronchoscopic findings and the angiograms should
be most useful when using bronchoscopy in the management and treatment of bronchial arterial lesions.

REFERENCES

CRITICAL CARE EXAMINATION REVIEW COURSE

Dates: September 14-17, 1987, Washington, DC
Location: The Shoreham Hotel, Washington, DC
Sponsor: American College of Chest Physicians
Course Director: D. Robert McCaffree, M.D., FCCP

Course Description:
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