Flexible Fiberoptic Bronchoscopy and Endobronchial Tamponade in the Management of Massive Hemothysis

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Flexible fiberoptic bronchoscopic examination with systematic bronchial lavage was performed in ten patients with massive hemothysis. Localization of the bleeding to the distal segments of the bronchial tree and endobronchial balloon tamponade were achieved in all cases. The technique is rapid, simple, and effective in controlling life-threatening hemothysis in patients who are unsuitable for resection due to inadequate pulmonary reserve or other causes.

Massive hemothysis is a fearful catastrophe associated with a disturbingly high morbidity and mortality. Massive hemothysis has been arbitrarily defined as the expectoration of 600 ml of blood or more within 24 hours.1,2 The single most important factor influencing mortality in this life-threatening complication is the rate of bleeding. The overall mortality was 37 percent (25 patients) of the 67 patients with a blood loss of 600 ml or more within 48 hours and rose to 75 percent if hemothysis exceeded 600 ml in 16 hours.3

Immediate bronchoscopic localization of the site of hemorrhage followed by early thoracotomy and resection of the source of bleeding constitutes ideal management; however, in some instances, pulmonary insufficiency and other coexisting medical problems will obviate attempts at surgical intervention. Management in these cases by conventional methods of therapy has resulted in a high mortality.4,4

The use of the flexible fiberoptic bronchoscope with systematic lavage of the tracheobronchial tree not only permits more precise identification of the source of hemorrhage, but also allows for selective cannulation and tamponade of the bleeding segmental or subsegmental bronchus with a Fogarty catheter balloon. The value of selective endobronchial tamponade with the Fogarty balloon has been evaluated in ten consecutive patients with massive hemothysis. This preliminary report describes our experience with this method of management.

Materials and Methods

From June 1975 through March 1976, emergency bronchoscopic examination was performed on ten consecutive patients with massive hemothysis, using a flexible fiberoptic bronchoscope (Olympus BF-5B2). There were seven men and three women, with an age range from 23 to 72 years. Seven patients had limited ventilatory reserve, one had multiple trauma, one had a lobectomy after initial control of hemorrhage with endobronchial balloon tamponade, and one patient refused surgery.

The technique of systematic segmental bronchial lavage with localization and tamponade of the bleeding site with a No. 4 French 100 cm Fogarty catheter balloon has been previously described by us.5 Bronchoscopic examination was performed under topical anesthesia in all patients within 24 hours of their admission to the hospital. All were actively bleeding at the time of bronchoscopic examination. The loss of blood was documented in each case by measuring the amount expectorated in graduated containers from the time of admission.

The causes of massive hemothysis were cavitary tuberculosis in six patients (all of whom had positive sputum smears), bronchiectasis in three patients, and pulmonary contusion due to blunt trauma in another patient (Table 1). None of the patients required blood transfusion prior to bronchoscopic examination. The drop in the hematocrit reading varied from 4 percent to 12 percent, with an average drop of 8 percent per patient.

The site of bleeding was localized on the initial bronchoscopic examination, and successful balloon tamponade was achieved in all patients. The balloon was deflated after 24 hours, and the catheter was removed if there was no recurrence of hemorrhage after a few hours.

There was no significant complication directly related to the procedure. Damage to the bronchial mucous membrane or segmental atelectasis could occur from prolonged balloon tamponade; however, these complications were not observed clinically or by serial chest roentgenograms in this group of patients. Nine of ten patients were discharged from the hospital within two weeks and have remained well, with no recurrence of hemothysis during a follow-up period varying

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from six weeks to nine months. There was one death during hospitalization in a very obese diabetic patient with bilateral cavitary tuberculosis. Two weeks after cessation of hemoptysis, this patient developed acute renal failure and sepsis, from which she subsequently died. One patient underwent successful resection for bronchiectasis following initial control of hemorrhage with endobronchial balloon tamponade (Fig 1 to 3).

**DISCUSSION**

Pulmonary resection has been recommended as the preferred treatment for life-threatening hemoptysis. The surgical mortality has ranged from 15 to 20 percent in most reported series; however, resection for massive hemoptysis is clearly not warranted in patients with inoperable or disseminated bronchial carcinoma, extensive bilateral tuberculosis, marginal cardiopulmonary reserve, diffuse pulmonary metastasis, or associated grave medical conditions. The mortality in this group of patients treated

<table>
<thead>
<tr>
<th>Patient, Age, Sex</th>
<th>Diagnosis</th>
<th>Rate of Bleeding</th>
<th>Location of Bleeding*</th>
<th>Drop in Hematocrit, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 72, M</td>
<td>Active tuberculosis</td>
<td>650 ml/10 hr</td>
<td>Posterior segment, RUL</td>
<td>43 to 32</td>
</tr>
<tr>
<td>2, 53, M</td>
<td>Bronchiectasis</td>
<td>950 ml/12 hr</td>
<td>Apical segment, RUL</td>
<td>46 to 41</td>
</tr>
<tr>
<td>3, 60, M</td>
<td>Bilateral cavitary tuberculosis</td>
<td>650 ml/24 hr</td>
<td>Apical segment, RUL</td>
<td>39 to 33</td>
</tr>
<tr>
<td>4, 63, F</td>
<td>Bilateral cavitary tuberculosis</td>
<td>900 ml/6 hr</td>
<td>Apical-posterior segment, LUL</td>
<td>36 to 32</td>
</tr>
<tr>
<td>5, 23, M</td>
<td>Cavitary tuberculosis</td>
<td>600 ml/3 hr</td>
<td>Anterior segment, LUL</td>
<td>46 to 34</td>
</tr>
<tr>
<td>6, 25, F</td>
<td>Pulmonary contusion</td>
<td>300 ml/2 hr</td>
<td>Posterior segment, RUL</td>
<td>39 to 32</td>
</tr>
<tr>
<td>7, 25, M</td>
<td>Active tuberculosis</td>
<td>700 ml/18 hr</td>
<td>Posterior segment, RUL</td>
<td>42 to 34</td>
</tr>
<tr>
<td>8, 37, M</td>
<td>Bilateral cavitary tuberculosis</td>
<td>900 ml/18 hr</td>
<td>Apical-posterior segment, LUL</td>
<td>46 to 38</td>
</tr>
<tr>
<td>9, 65, M</td>
<td>Bronchiectasis; pneumonia</td>
<td>1,200 ml/12 hr</td>
<td>Apical segment, RUL</td>
<td>44 to 32</td>
</tr>
<tr>
<td>10, 68, M</td>
<td>Bronchiectasis</td>
<td>850 ml/24 hr</td>
<td>Lateral basal segment, LLL</td>
<td>43 to 37</td>
</tr>
</tbody>
</table>

*RUL, right upper lobe; LUL, left upper lobe; and LLL, left lower lobe.

**Figure 1.** Chest radiograph showing cuffed endotracheal tube in right main bronchus to prevent aspiration of blood after initial achievement of endobronchial balloon (arrow) tamponade of bleeding segment in left upper lobe of patient requiring assisted ventilation (case 4).

**Figure 2.** Chest radiograph showing fiberoptic bronchoscope being withdrawn after inflation of Fogarty balloon (arrow) to tamponade bleeding focus in anterior segment of left upper lobe (case 5).
nonsurgically was 78 percent (seven) of nine patients reported by Crocco et al., 80 percent (four) of five patients reported by Gourin and Garzon,1 and 23 percent (ten) of 43 patients reported by Yeoh et al.6 In our group of ten consecutive patients with massive hemoptysis who were treated nonsurgically with selective endobronchial balloon tamponade of the bleeding focus through a flexible fiberoptic bronchoscope, there has been no mortality or serious morbidity from the procedure.

The use of the Fogarty balloon for bronchial blockage was first described in connection with the rigid bronchoscope; however, because of its limited range of visibility and poor tolerance by the acutely ill patient, we prefer the flexible fiberoptic bronchoscope, which can be used with the patient sitting upright, lying on his bleeding side, or at the bedside. The rigid bronchoscope was used in one patient (case 9) with profuse, brisk bleeding to accomplish rapid evacuation of blood from the bronchial tree, prior to using the flexible fiberoptic bronchoscope to precisely localize the site of hemorrhage to the posterior segment of the right upper lobe.

In obtunded patients the double-lumen tube of Robertshaw7 may be used to prevent contralateral aspiration of blood to the nonbleeding side, while bronchoscopic examination can be performed by passing the flexible fiberoptic bronchoscope through the other lumen. The Carlens tube has been unsatisfactory in our hands, due to difficulty in placement and the smallness of the lumina, which made suction inadequate.

Pulmonary tuberculosis is the most common cause of massive hemoptysis in most reported series,1-8 and the upper lobes appear to be the most frequent major foci of disease. The advent of the flexible fiberoptic bronchoscope has permitted more adequate visualization of the upper lobes to include evaluation of bronchi of the fourth and fifth order. This has allowed more precise identification of the bleeding point at the segmental and subsegmental levels; and with the selective placement of the Fogarty catheter, the balloon can be inflated to occlude the bleeding area. This technique is applicable not only in patients who are unsuitable for major resection, but also in good-risk patients to achieve temporary tamponade of the bleeding focus until adequate preparation can be made and surgical resection safely accomplished.

REFERENCES