Management of Massive Hemoptysis

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Massive hemoptysis demands immediate investigation and treatment. Bronchoscopy done while the bleeding is active is essential to accurate localization of the site of origin and the cause of hemorrhage. Emergency pulmonary resection should be carried out if death is to be prevented by suffocation or exsanguination. Illustrative cases are presented.

Hemoptysis is massive when the blood loss, in a single expectoration, is 500 cc or more. Smaller, single losses can also be classified as massive if the total amount of blood lost over a period of several days, is 1000 cc or greater.1 Massive hemoptysis threatens life both because of the hypovolemia associated with severe blood loss and because of the possibility of suffocation. The latter may occur even with relatively lesser degrees of bleeding.2

Therefore, any patient with massive hemoptysis should be regarded with the gravest concern. Continuing massive hemorrhage makes emergency operation mandatory. If the bleeding has stopped early operation is indicated after appropriate investigation of cause of bleeding.

The following cases illustrate difficulties encountered in the management of massive hemoptysis:

Case 1 (11691 65): This 56-year-old white woman was admitted June 25, 1966, with hemoptysis of five days' duration. She had been seen first at another hospital where she received 1500 cc of blood. Bronchoscopy, done while there was active bleeding, showed the blood to be coming from the left lung. Chest x-rays were compatible with left lower lobe bronchiectasis. At the time of admission to Henry Ford Hospital, her condition appeared stable; she was pale and had occasional blood-tinged sputum, but the bleeding seemed to be subsiding. She was placed on bed rest, given sedation and observed closely while further investigations were carried out. On the following day, she suddenly coughed up an estimated 1500 cc of bright red blood. Although the blood loss was replaced promptly, she continued to bleed massively and she suffocated while arrangements were being made to carry out emergency resection. At autopsy, massive tracheo-bronchial aspiration of blood was found. Lingular bronchiectasis with ulceration was the source of the bleeding.

Comment: This patient's illness was characterized by massive hemoptysis followed by a 24-hour period of apparent stabilization and, finally, massive fatal hemorrhage. Attempts should have been carried out to localize more precisely the origin of the bleeding in the left

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lung by bronchoscopy and emergency pulmonary resection done while the patient was stable and the bleeding was slight. The dramatic sequence of events in this case points out that diminution or temporary cessation of the hemorrhage does not signal the end of the emergency and emphasizes the need for prompt and effective treatment once massive hemoptysis has occurred.

Case 2 (126 25 05): This 51-year-old Negro was apparently in excellent health until three hours prior to admission on December 16, 1966, when he developed sudden, severe, sharp pleuritic pain in the right parascapular area. This was followed two hours later by expectoration and vomiting of large amounts of fresh blood and blood clots. There was no history of tuberculosis, previous lung disease or bleeding diathesis. Chest x-ray taken three months before was said to be normal.

Examination showed he was well developed and nourished; blood pressure 80/50, pulse 120 per minute; temperature 99°; with bilateral, coarse rales. The remainder of the examination was negative. The chest x-ray showed a right upper lobe infiltrate and diffuse, patchy densities throughout both lungs (Fig. 1). Laboratory examinations, including blood clotting studies were within normal limits. Blood replacement was started immediately. As the patient was both coughing and vomiting large amounts of blood and his cough was effortless, a Sengstaken tube was passed into the stomach and it was ascertained that the bleeding did not originate from the upper gastrointestinal tract. Bronchoscopy, done under

Figure 1 - (Case #2)

Chest x-ray showing a right upper lobe infiltrate and diffuse patchy densities in both lungs.
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local anesthesia, showed a continuous stream of blood coming out of the right upper lobe bronchus. Four hours after admission a total of 4500 cc of blood had been transfused. An emergency right upper lobectomy was carried out. A Carlen's tube was not used, due to technical difficulties. In spite of early control of the right upper lobe bronchus there was considerable aspiration into the remainder of the lungs. Tracheostomy, assisted ventilation and steroids were used postoperatively with gradual and complete improvement by the time of discharge two weeks later. Examination of the resected specimen showed multiple, bronchial ulcerations (Fig. 2) and submucosal and alveolar hemorrhage. The patient has remained well with no further bleeding.

Comment: Exsanguinating hemoptysis was present in this case. Differential balloon tamponade excluded the possibility of gastric or esophageal bleeding and bronchoscopy accurately localized the origin of the hemorrhage to the right upper lobe bronchus. An adequate blood volume was maintained by rapid replacement of the blood lost, and permanent control of the bleeding was obtained by immediate lobectomy. Diagnostic and therapeutic measures, proceeding simultaneously and promptly, led to this patient's recovery.

Figure 2 - (Case #2)

Microphotograph of the resected right upper lobe bronchus showing bronchial ulceration.

Case 3: (111 05 45): This 44-year-old Negro woman, admitted shortly after expectorating an estimated 400 cc of bright red blood, had a history of several bouts of pneumonitis and chronic cough productive of greenish, foul-smelling sputum which had been blood streaked on several occasions.

Physical examination revealed dullness and bronchial breathing in the right lung base, hemoglobin 9.9 grams, and sputum negative for acid fast bacilli on smear. Radiographic studies showed right lower lobe consolidation with multiple cavitations and calcific nodes (Fig. 3). The bleeding stopped while the patient was on bed rest and sedation but recurred two days later when she coughed up about 300 cc of blood.

Bronchoscopy was done under local anesthesia while there was active bleeding and showed the blood to be coming from the right lower lobe. The hemorrhage subsided a few hours later, but the following morning the patient once more started coughing sub-
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Substantial amounts of blood. She was taken to surgery immediately and a right lower lobectomy was done. A Carlen's tube was used to prevent aspiration into the remainder of the lungs. The excised lobe showed, according to the medical record, "severe bronchiectasis with multiple broncholiths. One calcified node was eroding through the wall of the main basilar bronchus." Convalescence was uneventful, and she has remained well without further bleeding.

Comment: The problem in this patient was that of repeated bouts of moderately severe bleeding as a result of chronic bronchiectasis and broncholithiasis. Although not alarming at first, the hemorrhage became life-threatening through its recurrence. Bronchoscopy disclosed unquestionably the site of origin of the bleeding and permitted its prompt and definitive control by emergency lobectomy.

Figure 3 - (Case #3)
Tomogram showing dense consolidation of the right lower lobe. Multiple cavitations and intraluminal calcific densities can be seen.

Discussion

Hemoptysis, however slight, is a frightening symptom to most patients. This fear is not unwarranted since expectoration of blood is frequently a sign of serious underlying disease with bronchogenic carcinoma, tuberculosis and bronchiectasis as the responsible factor in the majority of cases. Cardiovascular disease, mainly mitral stenosis, can also be associated with hemoptysis, which may at times be severe.

Non-Massive Bleeding: In most patients the bleeding is not massive and there is ample time for a thorough and unhurried investigation of its cause. This should
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include a careful history, a thorough physical examination, bacteriologic and cytologic studies of the sputum, assessment of the clotting mechanism, routine chest films and laminographic survey of any lung pathology found. Bronchoscopy should be carried out, preferably while the bleeding is still active. Bronchograms may also be done, particularly if bronchiectasis is suspected. When the hemorrhage is slight, it usually stops under conservative therapy. This includes bed rest, light sedation and postural drainage.

**Massive Bleeding:** If the hemoptysis is massive, exsanguination or air-way obstruction or both may quickly cause death, so investigation of the source of the bleeding and therapeutic measures should be carried out without delay.

**Investigating the Source of Bleeding:** A thorough history may disclose evidence of tuberculosis or cardiac disease. Associated or previous bleeding from other organs may suggest a systemic disease such as Wegener's granulomatosis or Goodpasture's Syndrome. Besides providing clues as to the etiology of the bleeding, the history is often helpful in localizing its source as the patient may be aware of a unilateral wheeze or a "trickling sensation" in the side of the chest from which the hemorrhage is originating. On occasion, the bleeding is so massive that the patient may swallow large amounts of blood which, upon being vomited, may suggest massive upper gastrointestinal bleeding with secondary tracheobronchial aspiration rather than primary bronchopulmonary hemorrhage (Case 2). The absence of a history of alcoholism, jaundice or ulcer symptoms will help to eliminate any confusion.

A careful physical examination is also essential. Particular note should be made of cyanosis, finger clubbing, cutaneous angiomata and heart murmurs. Chest dullness, rales and localized wheezing may help to determine the site of bleeding but they should be interpreted with caution as they may be the result of aspiration of blood into other segments of the tracheobronchial tree. Roentgenographic studies of the chest should be carried out immediately. The presence of a cavity, a mass, a lobar collapse or a unilateral infiltrate may localize the source of bleeding. Tomograms and bronchograms may be obtained if the severity of the hemorrhage allows it. Bronchoscopy while the bleeding is still active is probably the most important diagnostic study. It will determine the side of the bleeding and will often disclose the lobar orifice from which the blood is coming. In addition, the etiology of the hemorrhage as a specific lesion may also be visualized. The procedure should be done under light premedication and topical anesthesia to avoid depression of the cough reflex and further aspiration of blood. Facilities for immediate thoracotomy should be available at this time.

**Treating Massive Hemoptysis:** The main objectives in the treatment of the patient with massive hemoptysis are: 1) maintenance of the airway, 2) replacement of the blood loss, and 3) definitive control of the source of bleeding. This therapeutic phase should progress simultaneously with the diagnostic studies.
Maintenance of the Airway: If the site of origin of the bleeding has been determined, the patient should lie on the affected side to minimize contralateral aspiration. When tolerated, a slight head-down position may be used to improve postural drainage. The patient's own cough reflex is of utmost importance in maintaining a clear airway and should not be unduly depressed with medication. If the cough is ineffective, frequent endotracheal aspiration may be necessary. Tracheostomy or bronchoscopy may have to be used to preserve patency of the airway.

Definitive Control of the Source of Bleeding: If the bleeding is massive and suffocation (Case 1) or exsanguination (Case 2) seem imminent and the site of bleeding has been determined, immediate pulmonary resection should be carried out as a major surgical emergency. A double-lumen endotracheal tube should be used to prevent further aspiration.

When the hemoptysis has become massive through several bouts of bleeding over a period of several days, there is usually opportunity to determine precisely the site from which the hemorrhage is originating and, often, the underlying pathology as well. In the presence of persistent or recurrent severe hemoptysis, resection should be done without further procrastination (Case 3).

A single episode of severe hemorrhage may stop spontaneously. Case 1 emphasizes, however, the urgency with which diagnostic studies and definitive treatment should proceed during the period of quiescence if a fatality is to be avoided. The lack of a precise etiologic diagnosis should not deter early thoracotomy if at least the side from which the bleeding originates is known.

REFERENCES