

Massive hemoptysis

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Hemoptysis is usually a symptom of cardiopulmonary disease and is generally not in itself associated with death. A blood loss into the tracheobronchial tree of 600 ml in 24 hours or at a rate that poses a threat to life is referred to as massive hemoptysis. Hypervascularity within the bronchial circulation, usually associated with diffuse inflammatory disease of the lung, is common in patients with massive hemoptysis. Management should be directed at maintenance of oxygenation and localization of the source of bleeding. Temporizing maneuvers such as iced saline lavage, intravenous administration of vasopressin, endobronchial tamponade and bronchial artery embolization will often stabilize the patient in preparation for definitive surgery. Such a sequential plan of management may result in a 50% reduction in the rate of death from massive hemoptysis, which is otherwise 50% to 100%.

L'hémoptysie, reliée le plus souvent à une maladie cardiopulmonaire, n'est pas nécessairement mortelle. Mais lorsqu'elle est massive, soit la perte trachéobronchique de 600 ml de sang sur 24 heures, elle constitue un risque vital. C'est souvent le fait d'une hypervascularisation bronchique résultant ordinairement d'une inflammation pulmonaire diffuse. La conduite à tenir est d'assurer les échanges gazeux et de rechercher la source du saignement. Les interventions immédiates (irrigation au soluté glacé, vasopressinothérapie endoveineuse, tamponade endobronchique et embolisation des artères bronchiques) permettent souvent de stabiliser le malade et de

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le préparer à une intervention définitive. Cette manière séquentielle de procéder peut couper de moitié une mortalité qui sans elle varie de 50% à 100%.

The coughing up of blood is known as hemoptysis. The expectorated material may vary from blood-tinged sputum to frank blood and may emanate from any portion of the respiratory tract, including the nose and throat, from which it may be inhaled and subsequently expectorated. Most commonly, hemoptysis results from infections, neoplasms, cardiovascular disorders or trauma. However, Goodpasture's syndrome and disorders of coagulation must be considered.

Hemoptysis is generally not associated with death, but in a small percentage of patients the bleeding becomes massive and may be life-threatening. In such patients asphyxiation is a greater danger than exsanguination.

There is no consistent definition of massive hemoptysis, though a blood loss of 600 ml in 24 hours is commonly accepted.¹ A functional definition is bleeding into the tracheobronchial tree at a rate that poses a threat to life. The rate of death from hemoptysis of this type has been variably reported as 50% to 100%.²

The main causes of massive hemoptysis are tuberculosis, bronchiectasis, pneumoconiosis, aspergilloma and bronchial carcinoma. By far the commonest of these are active and inactive tuberculosis, which together account for up to 70% of cases.^{2,3} Unlike most patients with low-volume hemoptysis, all patients with these disorders have inflammatory lesions that are associated with hypervascularity within the lung. This hypervascularity results from development and dilatation of collaterals within the bronchial circulation.

Management approach

A number of specific medical and surgical

forms of therapy have been advocated for cases of massive hemoptysis,^{4,5} but for all cases certain principles of therapy should be recognized. Because the mechanism of death is generally asphyxiation, every effort should be made to prevent flooding of the opposite lung. This presumes that one is aware of the site of bleeding. The site may be localized from the symptoms, and the accuracy of the localization may be strengthened by the results of chest radiography. However, both symptoms and findings on plain chest x-ray films may be misleading, particularly in patients that have generalized inflammatory conditions of the lung.

The best means of identifying the source of bleeding is bronchoscopy.⁴ Many have advocated rigid bronchoscopy as the procedure of choice because besides providing a diagnosis it establishes an airway and the instrument can be used for large-volume isotonic saline lavage.^{3,4,6} This is not a uniformly accepted rationale, some clinicians preferring fiberoptic bronchoscopy.⁷ The practice varies from centre to centre and depends primarily on the availability of bronchoscopists and the method with which they are most comfortable. Either method will localize the site of bleeding in up to 90% of patients.² Once the site has been determined the patient should be positioned such that the bleeding lung is dependent.

All patients will require supplementary oxygen and endotracheal intubation, the latter allowing for tracheobronchial toilet and the use of mechanical ventilation with positive end-expiratory pressure (PEEP). PEEP not only may improve oxygenation but also, to the extent that it increases intrathoracic pressure, may provide a measure of tamponade to the site of hemorrhage.

Once an airway is established and the patient is properly positioned, the coagulation status should be reviewed and abnormalities corrected, although it is rare for disorders of coagulation to present as massive hemoptysis.³

Because massive hemoptysis is virtually always unilateral, double-lumen endotracheal tubes have been used to protect the nonbleeding lung from aspiration. Gourin and Garzon,⁸ however, reported death as a result of massive aspiration of blood during surgery in four of their first seven patients managed with these tubes. It may be that the reduced internal diameters of double-lumen tubes do not allow for proper tracheobronchial toilet. Patients that are exsanguinating may have blockage of the lumen and failure to ventilate. Single-lumen, low-pressure, high-compliance, cuffed endotracheal tubes are currently in vogue.

Medical treatment

While conservative management may suffice for many cases of low-volume hemoptysis it should never be used for massive hemoptysis.

In 1950 the use of intravenous injections of 10 U of vasopressin was first reported to be valuable

for hemoptysis associated with tuberculosis, bronchiectasis and other types of cavitary lung disease.⁹ Subsequent reports have described successful treatment of massive hemoptysis with intravenously administered vasopressin.¹⁰ This form of therapy may be undertaken as a temporizing maneuver to allow for stabilization before definitive therapy. It may also be used for patients that are exsanguinating and in whom localization of the site of bleeding has not been possible or in those who are not candidates for definitive surgery. Because the leading causes of massive hemoptysis are associated with bleeding from the bronchial circulation, direct vasoconstriction of the systemic circulation is the factor that accounts for any therapeutic efficacy of vasopressin.

Other medical forms of therapy that have been proposed include estrogenic substances administered intravenously,¹¹ vitamin K₁ oxide¹² and protamine sulfate.¹³ None of these agents have been shown to induce either temporary or sustained benefit.

Cold saline lavage is a useful means of managing some patients with massive hemoptysis. This is performed as a continuation of bronchoscopic localization and is best done through the rigid bronchoscope. Conlan and associates³ reported 12 successive cases of massive hemoptysis managed with lavage. All the patients stopped bleeding during the procedure. The site of bleeding was localized to a single lobe in seven cases and lateralized to the left or right lung in the remainder. Emergency thoracotomy was avoided, and further medical or surgical therapy was conducted after stabilization.

Whether or not definitive surgery is carried out, all patients with massive hemoptysis require protection of the contralateral lung from aspiration of blood. Once the site of bleeding is identified by bronchoscopy, endobronchial tamponade may be used in any case of bleeding from the left lung or the lower lobe of the right lung.

Blocking the upper lobe of the right lung with a balloon in the right main bronchus is not advisable. This bronchus is short, and most forms of endobronchial blockade tend to shift into the trachea or downward, towards the lower lobe, thus resulting in a failure to control either ventilation or bleeding.

In cases of bleeding from the right lung the bronchoscope is removed and replaced by a single-lumen, cuffed tube, which is advanced into the left main bronchus. This is a satisfactory mechanism of isolating the right lung while a patient is prepared for surgery. As soon as the bronchus is dissected and cross-clamped the tube may be deflated and withdrawn from the left main bronchus into the trachea.

Bleeding from the left lung may be dealt with by inserting a Fogarty occlusion catheter through the bronchoscope into the left main bronchus, then inflating the balloon to provide tamponade. After withdrawal of the bronchoscope an endotracheal

tube is inserted, which secures the Fogarty catheter against the tracheal wall.

Gourin and Garzon⁸ reported on 15 patients treated by endotracheal tamponade. Hemostasis was achieved in all 15, and there were no deaths. Garzon and other colleagues¹ reported on 10 patients, in all of whom bleeding was controlled by bronchial blockers until definitive surgery was possible.

The final method for nonsurgical management of massive hemoptysis is bronchial artery embolization,¹⁴ which is potentially hazardous on the right side when there is a common origin of the bronchial artery and the spinal radicular artery. This anatomic variation exists only occasionally and is a contraindication to embolization.

Uflacker and coworkers¹⁵ reported lasting control of hemoptysis for 1 to 24 months in 80% of 33 patients with massive hemoptysis who underwent selective bronchial arteriography and embolization. No unfavourable sequelae were described. These authors recommended extreme caution if the anterior spinal circulation is demonstrated by angiography. Others have recommended that bronchial artery embolization not be undertaken if the anterior spinal circulation is displayed.¹³

For embolization most radiologists use Gelfoam cut into small fragments.¹⁴⁻¹⁶ Injection of absolute ethanol has been reported¹⁷ but carries a higher risk of spinal cord damage.

Though massive hemoptysis can be effectively controlled with embolization, this is only a temporizing maneuver. Bleeding can recur as a result of absorption of the embolized material or revascularization and recanalization. Bronchial artery embolization may be used as palliative therapy if the primary cause of the hypervascularity and inflammation cannot be surgically treated.

Surgical treatment

Because most of the disorders that result in massive hemoptysis are inflammatory, and because temporizing means of controlling bleeding do not deal with the underlying cause, surgery should be offered to any patient able to withstand anesthesia and pulmonary resection in whom the site of bleeding can be localized. This can halve the risk of death, which is otherwise 50% to 100%.

The results of surgical therapy are excellent. Both the magnitude of the pulmonary resection and the amount of bleeding in the 24 hours immediately preceding the surgical procedure are directly related to the risk of death. Severe bleeding at the time of resection, necessitating single lung ventilation, increased the mortality rate in the series reported by Garzon and colleagues¹ from 7% to 33%.

Specific surgical approaches must be individualized, but segmentectomy or lobectomy is preferred. Surgery should not be withheld from patients that have active tuberculosis or incompletely

treated lung abscess. Crocco and associates² reported that of 16 patients with active tuberculosis that underwent surgery before receiving complete medical therapy none had postoperative complications, and the tuberculosis adequately resolved with subsequent chemotherapy.

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