Non-surgical Treatment for Recurrent Hemoptysis Due to a Pulmonary Aspergilloma: A Case Report

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Abstract

Aspergilloma is a distinct form of chronic pulmonary aspergillosis characterized by the formation of a fungal mass composed of living and dead *Aspergillus* hyphae, inflammatory cells, and tissue debris within preexisting lung cavities. The condition is predominantly caused by *Aspergillus fumigatus*. Aspergillomas are classified as simple or complex based on cavity wall thickness and surrounding lung parenchyma. Complex aspergillomas develop in thick-walled, fibrotic cavities and present with more severe symptoms, including hemoptysis, chest discomfort, and impaired respiratory function. Although spontaneous resolution occurs in less than 10% of cases, surgical intervention, such as segmentectomy or lobectomy, is indicated for recurrent or life-threatening hemoptysis. Non-surgical options, including antifungal therapy and bronchial artery embolization, may be considered for patients with contraindications to surgery or milder symptoms. Early recognition and appropriate management are essential to reduce morbidity and mortality associated with this potentially life-threatening condition.

Keywords: Aspergilloma, hemoptysis, non-surgical treatment

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Introduction

Aspergilloma is a symptom of chronic aspergillosis in the lung that forms a mass of living and dead fungal components, inflammatory cells, fibrin, mucus, and tissue fragments within existing lung cavities. It is caused by Aspergillus fumigatus, which is the most prevalent pathogenic mold in humans. It grows in the previously existing lung cavities caused by lung diseases such as tuberculosis infection, cystic fibrosis, emphysema, or bronchiectasis.[1]

Aspergilloma can be classified into simple and complex forms. a single solitary cavitary lesion with thin walls and normal lung parenchyma is classified as simple aspergilloma and is commonly asymptomatic. on the other hand, complex aspergillomas grow inside the thick walls' cavities, which are surrounded by fibrous pulmonary tissue and capillary connections. This condition presents with more severe symptoms such as hemoptysis, chest discomfort, and reduced respiratory function.[2]

Less than 10% of aspergilloma cases could resolve spontaneously without intervention. Surgery is needed for recurrent hemoptysis, especially when the condition of life-threatening, such as massive hemoptysis with the risk of asphyxia.[3] Aspergilloma, despite of the diameter, could develop a risk for life-threatening hemoptysis with a high mortality rate. Surgery can be performed as a segmentectomy or a lobectomy, depending on the involvement of the lung segment. This condition also has a risk, especially in patients with previous lung impairment. Non-surgical procedures are an option for individuals who have contraindications to surgery or who do not prefer to undergo surgery. These options are

less harmful and may be an alternative for patients with simple or complex aspergilloma with less severe symptoms.[2]

Case presentation

A 45-year-old female patient arrived at the emergency ward with a chief complaint of recurrent hemoptysis that started 2 weeks before admission and worsened since yesterday. The latest blood volume was nearly 250 cc in 24 hours. The complaints were followed by shortness of breath and chest pain, specifically in the upper right side. The patient was reported to have experienced tuberculosis infection that was cured 1 year ago.

She previously had symptoms of a productive cough for 6 months ago but the symptoms were cured after taking the medication from the clinic. There were no known metabolic comorbidities such as diabetes mellitus, hypertension, and other systemic diseases related to his condition.

The patient's clinical condition was conscious, with vital signs showing blood pressure of 115/80, heart rate of 112 beats per minute, a respiratory rate of 24 times per minute without accessory respiratory muscle involvement, and peripheral oxygen saturation of 96% in the room air. The physical examination showed pale conjunctivae with no other abnormal signs in the head and neck region. A thoracic examination revealed asymmetrical lung expansion, vocal fremitus decreased in the right side, accompanied by dullness percussion in the right middle and lower region, amphoric sound in the mid region of the right lung, without ronchi or wheezing. The heartbeat was regular, with no abnormal heart sounds.

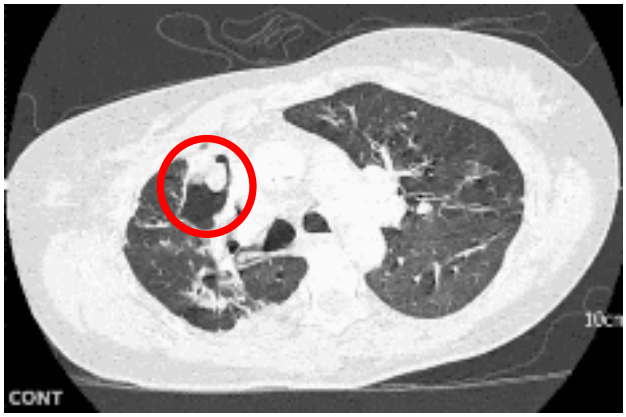

Figure 1. A fungus ball inside a cavitary lesion due to chronic lung disease (red circle).

Peripheral blood examination results showed hemoglobin concentration was low (6.5 g/dl) with no abnormalities in the blood coagulation result. The chest CT-scan revealed a round mass with soft-tissue attenuation within a preexisting lung cavity (air crescent sign) (Figure 1). KOH staining from the sputum sample found hyphae and yeast morphology. *Mycobacterium tuberculosis* was not detected in the sputum molecular examination (Figure 2). The patient's working diagnosis was massive hemoptysis due to suspected right lung aspergilloma.

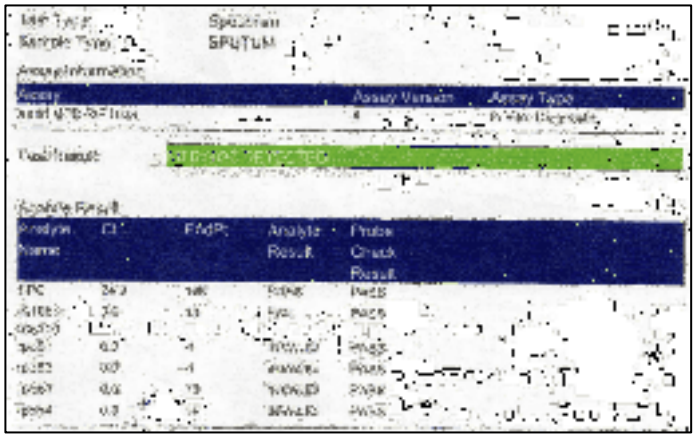

Figure 2. *Mycobacterium tuberculosis* was not detected in sputum examination.

The patient had received the protocol for massive hemoptysis. While giving the patient anti-hemoptysis medication and a packed red cell blood transfusion, the patient was planned to undergo bronchoscopy and surgery. Patient and family refused to get the surgery and bronchoscopy; in this case, medication treatment was planned using itraconazole to minimize the risk of recurrent hemoptysis in the future.

Discussion

Hemoptysis in aspergilloma occurs primarily due to the interaction between the fungus ball and the blood vessels lining the pre-existing lung cavity. Although some patients with pulmonary aspergilloma may be asymptomatic, hemoptysis occurs in nearly 80% of patients. Bleeding typically arises from arteries that supply blood to the lungs, such as the bronchial arteries.[4]

The main mechanisms include mechanical irritation and movement of the aspergilloma within the cavity, which can erode or damage the fragile capillaries and vessels in the cavity wall. The second is direct invasion or local inflammation induced by aspergilloma and the associated inflammatory response can cause ulceration and chronic inflammation of the cavity wall, leading to exposure and rupture of blood vessels, particularly the bronchial arteries. The next mechanism is the release of fungal toxins and enzymes that are secreted by the mold, which can further damage the vessel walls, promoting necrosis and bleeding. The last possible mechanism is the formation of fragile blood vessels (angiogenesis) around the lesion due to chronic inflammation, which are more prone to rupture. In severe cases, rapid cavity expansion or aggressive fungal growth can erode into larger vessels, resulting in massive and potentially fatal hemoptysis. Thus, hemoptysis is the most common and serious clinical manifestation of aspergilloma, often necessitating urgent intervention.[2,5]

According to the above mechanism, bronchial artery embolization is an effective therapeutic option for managing acute hemoptysis cases in pulmonary aspergilloma, especially in cases where surgical resection is not viable.[6] It also serves as a bridging therapy before definitive surgery. Significant adverse outcomes resulting from bronchial artery embolization are infrequent, and immediate clinical success, marked by the cessation of hemoptysis, is typically observed in 85% to 100%. However, the recurrence rate falls from 10% to 33%.[7]

Surgery is a key treatment option for pulmonary aspergilloma, especially in patients with recurrent or life-threatening hemoptysis. The most common surgical procedures include lobectomy, segmentectomy, wedge resection, and, in select cases, cavernoplasty or myoplasty.[3] Anatomical lung resection (such as lobectomy) is considered the gold standard to ensure complete removal and prevent recurrence, though less extensive procedures may be used in patients with limited pulmonary reserve. Recurrent or life-threatening hemoptysis is the most common and urgent indication for surgery in aspergilloma, as hemoptysis can be severe and potentially fatal in these patients.[8] A destroyed lobe or lung is also indicated for surgical intervention when the aspergilloma leads to significant destruction of lung tissue, compromising function, or increasing the risk of complications. The Failure of medical therapy or inability to exclude malignancy may be considered for the patient to undergo lobectomy or lung surgery if conservative management fails or if there is suspicion of cancer that cannot be ruled out by less invasive means.[9]

Surgery offers the best chance for cure, with 5-year survival rates after resection ranging from 80% to 93% in symptomatic patients, particularly those with significant hemoptysis. In contrast, the benefit of surgery in asymptomatic patients is less clear. Contraindications to surgery in patients with pulmonary aspergilloma primarily relate to the patient's overall health status and ability to tolerate the procedure. Poor general condition or significant comorbidities such as severe cardiopulmonary dysfunction, advanced age, or multiple comorbidities are at high risk for postoperative complications and mortality, making surgery inadvisable.[10] The individual with severely reduced pulmonary reserve with marginal lung function, often due to extensive underlying lung disease (such as advanced chronic obstructive pulmonary disease or destroyed lung from prior tuberculosis), may not tolerate lung resection. Patients with significant immunosuppression (e.g., from chemotherapy, chronic steroid use, or hematologic malignancies) are at increased risk for invasive disease and poor surgical outcomes, and surgery is generally avoided in these cases. Severely malnourished patients have higher surgical risk and poorer wound healing, making alternative treatments preferable. Surgery is also not indicated for patients with multifocal pulmonary involvement or invasive aspergillosis, as resection would not be curative and carries excessive risk. For these patients, non-surgical options such as bronchial artery embolization, cavernostomy, or medical pharmacology are considered safer alternatives.[2,11]

Surgery for aspergilloma is technically challenging due to dense pleural adhesions, inflammation, and altered anatomy from underlying diseases. Postoperative complications remain relatively high (25–70%), including prolonged air leak, empyema, bleeding, bronchopleural fistula, and respiratory failure. Mortality rates have improved in recent years, generally ranging from 2% to 7% in contemporary series.[12]

Pharmacological treatment with antifungal drugs can be used for aspergilloma, but its effectiveness is limited. Antifungal drugs are more effective for invasive or chronic pulmonary aspergillosis than for simple aspergilloma. In some cases, especially when surgery is not possible, antifungal therapy may help reduce symptoms, stabilize disease, or serve as adjunctive treatment.[13] The primary mechanism of action expected from pharmacological treatment of aspergilloma is the disruption of fungal cell membrane integrity and function, leading to inhibition of fungal growth or cell death. Triazole antifungals (e.g., voriconazole, itraconazole, posaconazole) will inhibit the cytochrome P450-dependent 14-α-demethylase enzyme (Cyp51A/B), a key enzyme in the ergosterol biosynthesis pathway. This inhibition leads to depletion of ergosterol, an essential component of the fungal cell membrane, resulting in loss of membrane integrity and accumulation of toxic sterol intermediates, ultimately disrupting fungal cell viability.

Polyenes (e.g., amphotericin B) will bind directly to ergosterol in the fungal cell membrane, forming pores that increase membrane permeability. This causes leakage of intracellular contents and leads to fungal cell death.[14] The last option is Echinocandins (e.g., caspofungin): Though less commonly used for aspergilloma, echinocandins inhibit (1,3)-β-D-glucan synthase, an enzyme necessary for fungal cell wall synthesis, resulting in weakened cell walls and osmotic instability.[15]

Pharmacological treatment for hemoptysis in aspergilloma primarily aims to reduce or stop bleeding by targeting the underlying fungal infection and stabilizing clot formation. Antifungal agents (e.g., itraconazole, voriconazole, amphotericin B) inhibit the growth or kill *Aspergillus* within the aspergilloma, reducing local inflammation and tissue destruction that contribute to vessel erosion and bleeding. By decreasing the fungal burden, antifungals may help prevent recurrence of hemoptysis, though their efficacy is often limited due to poor penetration into the fungal ball.[13] Direct delivery of antifungals into the cavity using a bronchoscope can more effectively reduce fungal load and local inflammation, leading to cessation or reduction of hemoptysis in some patients. Hemostatic agents (e.g., tranexamic acid) promote clot stability by inhibiting fibrinolysis, thereby helping to control active bleeding in cases of mild-to-moderate hemoptysis. The pharmacological approach focuses on reducing fungal activity and local vascular injury (to minimize further vessel erosion), and stabilizing clots to control active bleeding.[16] Non-surgical treatments are often effective for immediate control but are less durable, with a substantial proportion of patients experiencing recurrent bleeding over time.[10]

Conclusion

Pulmonary aspergilloma, most commonly caused by Aspergillus fumigatus, typically develops within pre-existing lung cavities and is characterized by the risk of life-threatening hemoptysis. While some cases may resolve spontaneously or remain asymptomatic, recurrent or massive hemoptysis is a major clinical concern and often necessitates intervention. Surgery remains the gold standard for definitive treatment, offering the lowest recurrence rates and highest long-term survival. However, surgical intervention carries substantial risks, particularly in patients with poor pulmonary reserve or significant comorbidities, making non-surgical options such as bronchial artery embolization (BAE) or pharmacological therapy more suitable for select patients. The choice of treatment should be individualized, balancing the risks and benefits of each approach based on the patient's clinical status, underlying lung function, and preferences.

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