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Endotracheal Actinomycosis Combined With Mucormycosis: A Case Report and Literature Review

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ABSTRACT

Actinomycosis and mucormycosis are rare infections, and their coexistence in a single host is extremely uncommon. Actinomycosis of the trachea is a chronic septic condition caused by actinomycete infection, often misdiagnosed due to the difficulty of obtaining microbiological evidence. Mucormycosis, an invasive fungal infection, is characterised by rapid progression and high mortality, commonly occurring in immunocompromised patients. A 58-year-old woman with poorly controlled diabetes presented with a whitish mass in the main bronchus, identified via bronchoscopy. Pathological biopsy confirmed actinomycosis with mucormycosis. After treatment with cryotherapy, Holmium Laser, amphotericin B, and penicillin, she was successfully discharged. When imaging suggests intratracheal lesions, early bronchoscopy and etiological investigation are crucial to avoid misdiagnosis.

1 | Introduction

Actinomycosis could occur in all organs of the body, most frequently the neck and face, but less frequently the chest and lungs, and even less frequently the endobronchus. It is a chronic suppurative and granulomatous disease caused by actinomycetes. Because of its vague clinical symptoms and imaging results, actinomycosis is easily susceptible to delayed diagnosis and therapy. Another invasive infection called mucormycosis, which is much rarer in medical settings. It is caused by a species of Mucorales. The most prevalent kind is nose–brain, followed by lung type, and it is uncommon to hear that the infection site only affects the main branch gas. Many common conditions, such as malignant lymphoma, uncontrolled diabetes, and immunosuppression, could all cover it up. Given its high mortality rate, poor prognosis, difficult diagnosis, and treatment, mucormycosis must get more attention. Recently, a case of endobronchial pulmonary actinomycosis complicated with mucormycosis was treated in our hospital. The report is provided below.

2 | Case Report

The patient is a 58-year-old woman who worked in the garment industry, with a history of diabetes for 10 years and poor blood glucose control. She was admitted to the hospital for shortness of breath for 1 month. Present medical history: in mid-July 2022, she suffered from shortness of breath with no evident cause, aggravated even when resting flat and prevented her from sleeping flat at night, with no other discomfort, only sporadic coughing with sticky phlegm. She was admitted to our hospital on August 11th. Chest CT-enhanced examination showed localised thickening and protuberance of the right wall of the trachea (Figure 1A,B), and no abnormal lesions in both lungs.

Zhujun Chen and Tingting Liu have contributed equally to this work.

Admission physical examination results included the following information: body temperature 36.2°C, pulse 106 bpm, respiratory rate 20 breaths/min, blood pressure 155/88 mmHg, height 165 cm, weight 57 kg, body mass index (BMI) 20.94 kg/m^2, no swelling of superficial lymph nodes, audible larynx during auscultation, normal breathing, bilateral symmetry of respiration was normal, low breath sounds of both lungs, scattered wheezing in both. glycated haemoglobin A 1c (HbA 1c) 10.7%, White Blood Cells and Neutrophils in a complete blood count, procalcitonin (PCT), C-reactive protein (CRP), interleukin-6 (IL-6), liver and kidney function were not abnormal, G test (1,3-β-D glucan test), GM test (Galactomannan test) Cryptococcus antigen test were negative, T-SPOT. TB (T cell spot test of tuberculosis infection) negative. The trachea was examined by tracheoscope on August 16th, 2022, a white mass (about 4.5 cm) observed on the right posterior wall of the trachea, and the lower end of the mass was about 5.3 cm from the glottis (Figure 2A). Each lobe's bronchial mucous membrane was smooth, with no erosion or bleeding. Each segment's bronchus opening was normal, the lumen was also normal, and there were no indications of intraluminal mass. Because there were few biopsy tissues and most of them were necrotic tissue, the tumour was biopsied again under the bronchoscope on August 16th, then the tumour was treated with holmium laser under general anaesthesia several times (energy 2J, frequency 20HZ, power 40 W). Finally, cryosurgery was performed at the Holmium Laser wound (Figure 2B). Pathological diagnosis on August 22: Actinomycetes combined with Mucor infection (Figure 2C,D).

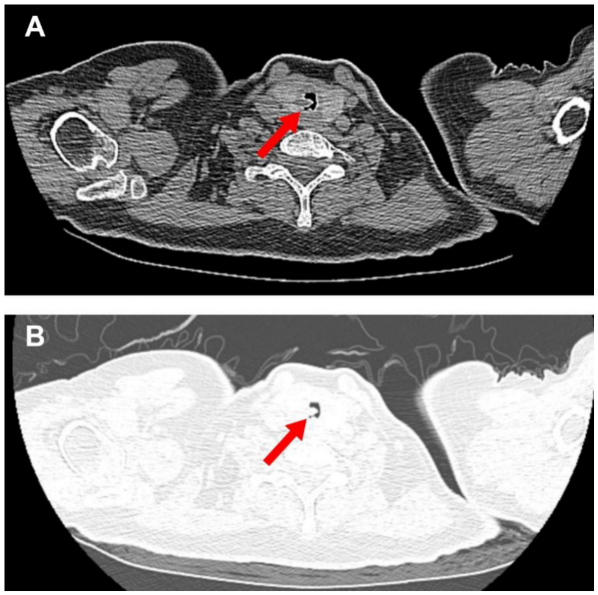

FIGURE 1 | Right wall localised thickening and prominence on chest CT images. (A) Mediastinal window. (B) Lung window.

Amphotericin B (Once every 12 h, each dose is 5 mg) atomization combined with intravenous (50 mg once daily) anti-Mucor therapy and Penicillin intravenous infusion was administered to treat actinomycetes beginning on August 22th, 2022. After treatment, the patient developed vomiting and lassitude, and creatinine increased from 74.3 to 150.60 μmol/L. Consult the pharmacy department doctor to consider the renal function damage caused by Amphotericin B.

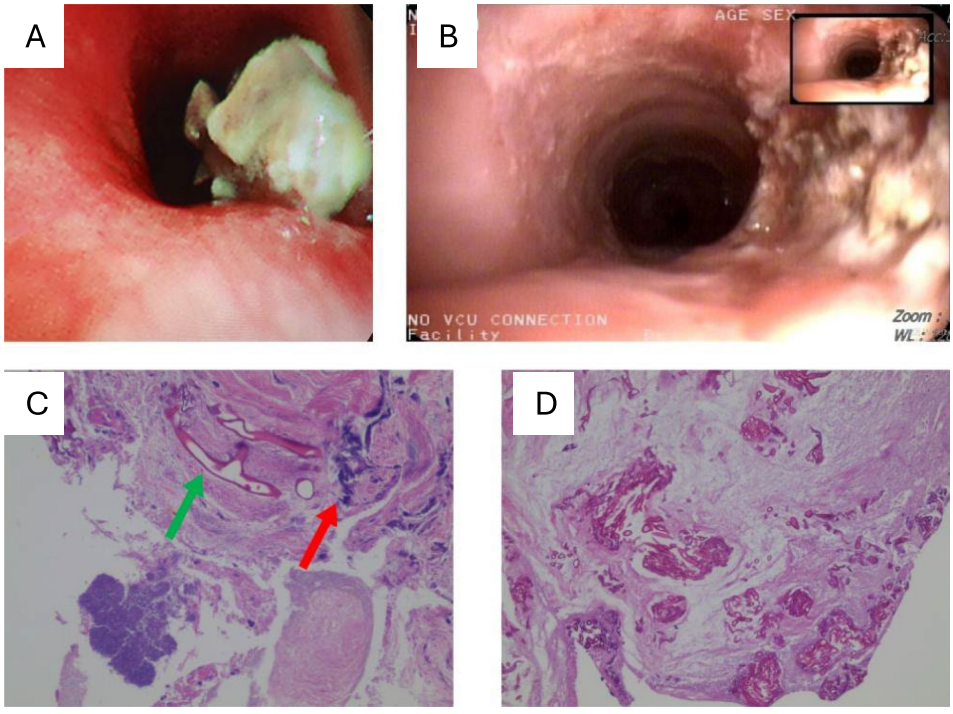

FIGURE 2 | (A) Under a fiberoptic bronchoscope, a whitish mass can be seen. (B) Endoscopic manifestations of multiple Holmium laser and cryosurgery under fiberoptic bronchoscopy. (C) Under the microscope, the HE staining of actinomycetes showed blue basophilic particles, some of the hyphae were arranged in the shape of actinomycetes, and the ends of the hyphae were often surrounded by a scabbard composed of colloidal substances (red arrow), and the HE staining of mucor was dark red, showing a long strip (green arrow) (HE × 200). (D) Mucor clusters, mycelia distributed around blood vessels and lumen thrombosis were seen under the microscope (HE × 400).

Stop intravenous infusion and retain atomization. Chest CT and fiberoptic bronchoscopy performed a month later revealed that the intratracheal lesions had entirely disappeared (Figure 3A–C).

3 | Discussion

Infectious disease incidence has been rising steadily in recent years as a result of risk factors such as aging population, extensive antibiotic usage, and the 2019-COVID pandemic [1]. Actinomycetes are the uncommon endogenous bacteria that cause actinomycosis. Cohn published the first account of actinomycosis in 1875, and now it has spread all over the world. Males tend to get actinomycosis at a rate that is 1.5–3.1 times higher than females. The taxonomic research on actinomycetes in China began in the 1950s [2]. The annual proportion in developing nations is considerably higher than the overall incidence recorded in the literature, about 1 in 300,000 [3], and the high rate of misdiagnosis may be the cause of the low reported incidence. Actinomycetes are widely distributed in nature, mostly anaerobic or micro-aerobic environment. They are normal colonised in human mucous membranes, such as the oral cavity, upper respiratory tract, digestive tract. Actinomycetes infection usually presents with local spread, suppuration, granulomatous inflammation and the formation of "sulfuric acid particles" in the sinus [3]. Actinomycosis is a type of illness that lacks typical clinical symptoms, requiring etiological evidence for diagnosis. The harsh actinomycetes culture conditions also contribute to the misdiagnosis and chronic infection. It is also easily confused with solid tumours, an active tuberculosis infection, and a fungal infection. Clinical diagnosis of the lethal vascular invasive fungal illness known as mucormycosis is challenging. Almost exclusively diabetic or immunocompromised patients experience it [4]. Rhizopus, Mucor, and Phoebes are the three primary fungi that cause mucor infection, with Rhizopus being the most prevalent. According to a meta-analysis of the mucormycosis cases reported by Jeong et al., diabetes account for roughly 40% of mucormycosis patients [5]. Patients with diseases of blood systems, weakened immune systems, and solid organ transplants appear to be at an increased risk for mucormycosis independently. In this case, the patient had a long history of diabetes, and her glycosylated haemoglobin level was 10.7%, showing that she had poor blood glucose management, which is comparable with the majority of cases that have been recorded [6–10]. Although the aetiology of diabetes-related mucormycosis is still unknown, it has been suggested that high blood sugar and low serum pH may make alveolar macrophages more vulnerable to spores and hyphae. The capacity of serum transferrin to bind iron can also be destroyed when ketoacidosis develops in diabetic individuals due to the binding of hyperglycemia and acidic pH, and the release of free iron promotes fungal fecundity [11].

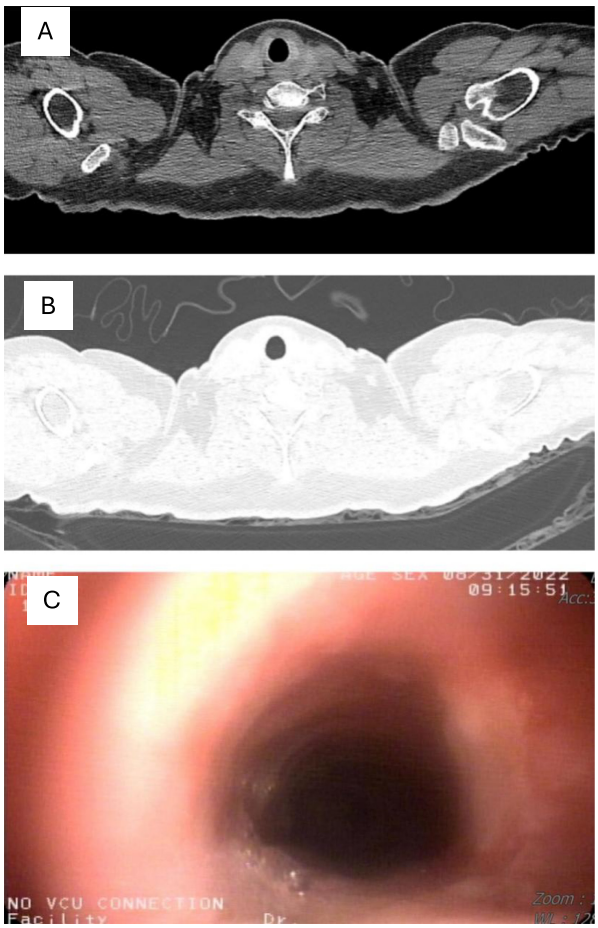

FIGURE 3 | No lesions were found in the trachea of repeat chest CT 1 month after treatment. (A) Mediastinal window; (B) lung window. (C) Fiberoptic bronchoscopy 1 month after treatment revealed no white lesions.

Patients who present with small nodules or mass-like solid lesions are typically asymptomatic, and the clinical manifestations of bronchial or pulmonary actinomycosis are not specific. Chronic cough was the most prevalent respiratory symptom, followed by low fever, hemoptysis, weight loss, exhaustion, and other symptoms that were comparable to the clinical signs of malignant tumours, pulmonary tuberculosis, and fungal infections [12, 13]. Some patients may develop bronchopleural fistulas as the condition worsens and release distinctive sulfur-like particles through the chest wall. After the initial cryotherapy with a fiberoptic bronchoscope, this case coughed up "dark yellow" particles, which are helpful for the diagnosis. The clinical signs of mucormycosis are likewise non-specific, respiratory symptoms such as cough, dyspnea, and hemoptysis, with or without chest pain. Six categories are used clinically to categorise it [14–16]. (1) Nose-brain type: The most common, with rapid progression and a high fatality rate (up to 80%). (2) Lung type: Symptoms resemble invasive aspergillosis, and pulmonary artery involvement may lead to fatal hemoptysis, particularly in patients with diabetes, tumours, or organ transplants. (3) Disseminated type: The infection spreads through the bloodstream, commonly affecting the brain. (4) Skin type: Often follows trauma or surgery, presenting as necrotising lesions; the least severe form. (5) Gastrointestinal type: Primarily affects malnourished children, leading to atypical ulcers and potential intestinal perforation. (6) Mixed type: A combination of the above forms.

Single or numerous masses, cavities, abscesses, and pleural effusion in the lung or bronchi were the CT symptoms of pulmonary actinomycosis [17]. The lesions were frequently seen on the lungs' periphery, and most of them displayed evidence of malignant tumours when they displayed signs of mass [18, 19].

Choi et al. [20] reviewed the risk factors for pulmonary mucormycosis, described its imaging appearance and disease process; PET-CT imaging clearly displayed increased glucose uptake, which was comparable to the symptoms of lung malignancies. The following imaging features of pulmonary mucormycosis are present [21]: (1) Single or multiple pulmonary consolidations, frequently accompanied by cavity; (2) Wedge-shaped shadow near the base of pleura; (3) single or multiple small nodules and halo sign; (4) anti-halo sign; (5) intratracheal lesions; (6) pleural effusion. The chest CT of this patient showed localised thickening and eminence of the right wall and no focus in the lung. It was easy to be misdiagnosed and missed by solely relying on imaging.

The definitive diagnosis of pulmonary mucormycosis or pulmonary actinomycosis relies on fungal microbiology and histopathology. Recent fungal antigen tests such as the G test and GM test have shown negative results in both mucormycosis and actinomycosis infections. The culture positivity rate in sputum, needle aspiration fluid, and bronchoalveolar lavage fluid is less than 5%, with an even lower positivity rate in blood cultures. Currently, the primary method for confirming pulmonary mucormycosis and pulmonary actinomycosis is Metagenomic Next Generation Sequencing (mNGS) in lavage fluid [22–24].

The first line of treatment for actinomycosis is intravenous infusion of Penicillin at 1800—24 million U/day for 2–6 weeks, followed by sequential amoxicillin (mild 3–6 months, severe 6–12 months). Second-line treatments include tetracycline, erythromycin, and clindamycin [25]. Isaconazole is moderately recommended for use as the first-line treatment for mucormycosis, but Amphotericin B liposome 5–10 mg/(kg d) is preferred [26].

In conclusion, endobronchial actinomyces and mucormycosis infections are uncommon and notoriously difficult to diagnose by routine biochemistry items. In order to prevent misdiagnosis and leakage, early pathogenic testing should be carried out if imaging reveals a bulge in the airway and white neoplastic organisms with necrosis on fibrinoscopy. An aggressive diagnostic and therapeutic approach is also crucial for a successful outcome.

Author Contributions

Zhujun Chen wrote the initial draft of the manuscript and collected the main data. Tingting Liu and Haiqing Guo managed the diagnosis and treatment. Hailing Duan and Bingjing Zhu reviewed and edited the manuscript; Yongfeng Chen and Liang Gong applied for funding. All authors read and approved the final manuscript.

Ethics Statement

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The authors have nothing to report.

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