Clin. Lab. 2024;70:XXX-XXX

CASE REPORT

Mycobacterium Infection of Abscess with Hemoptysis as the Initial Manifestation

Jingshan Bai [1], Wanyang Xu [1], Wenrui Li [1], Xiaoning Zhang [1], Kunyang Li [1], Yutao Zhou [2]

[1] *Department of Respiratory Medicine, Xiong'an Xuanwu Hospital, Xiong'an New Area, Hebei, China*
[2] *Department of Respiratory Medicine, Xuanwu Hospital of Capital Medical University, Beijing, China*

SUMMARY

Background: **Mycobacterium abscessus is a new pathogen in recent years, which belongs to non-tuberculosis mycobacterium. Mycobacterium abscessus is widely involved in many nosocomial infections and secondary aggravation of genetic respiratory diseases. Mycobacterium abscessus is naturally resistant to most antibiotics and is difficult to treat. We report a case of mycobacterium abscessus infection with hemoptysis as the first manifestation.**
Methods: **Bronchoscopy, next-generation sequencing (NGS).**
Results: **Acid-fast staining of bronchoscopic lavage fluid showed that a small amount of acid-fast bacilli could be seen. NGS test showed the presence of Mycobacterium abscess, sequence number 137 (reference range ≥ 0), and symptomatic treatment against non-tuberculosis mycobacteria.**
Conclusions: **For the follow-up infection of patients with hemoptysis, the treatment effect of antibiotics is not good, so the pathological tissue should be obtained by bronchoscopy or percutaneous lung biopsy in time, and the diagnosis should be confirmed by NGS if necessary.**
(Clin. Lab. 2024;70:xx-xx. DOI: 10.7754/Clin.Lab.2024.240209)

Correspondence:
Yutao Zhou
Xuanwu Hospital of
Capital Medical University
Beijing
China
Phone: +86 18332756601
Email: 851010509@qq.com

KEYWORDS

non-tuberculosis Mycobacterium, Mycobacterium abscess, bronchoscopy, next-generation sequencing

CASE REPORT

A 69-year-old woman was hospitalized with intermittent cough and expectoration for more than 50 years, accompanied by hemoptysis for 1 day. More than 50 years ago, she complained that there was no obvious inducement for intermittent cough, expectoration, yellow purulent sputum, large amount, no hemoptysis, intermittent use of anti-infective drugs (specific drugs and dosage unknown), and the therapeutic effect was acceptable. One day ago, there was no obvious cause of hemoptysis, showing bright red, the amount was about 200 mL. The patient had a history of hypertension for 10 years, and the highest blood pressure was 180/70 mmHg. At present, the blood pressure was not monitored regularly with carvedilol 6.25 mg QD and amlodipine besylate tablets 2.5 mg QD. The patient denied a history of tu-

Case Report accepted February 12, 2024

berculosis. Thick breathing sounds and a little wet rale in the right lung could be heard during auscultation in the lungs, and there was no obvious abnormality found in the physical examination.

After admission blood routine findings: RBC 3.2 x 10^{12}/L (reference value 4 x 10^{12}/L - 5.5 x 10^{12}/L), HGB 92 g/L (reference value 115 g/L - 150 g/L), WBC 20.43 x 10^9/L (reference value 4 x 10^9/L - 10 x 10^9/L), NEU 17.59 x 10^9/L (reference value 1.8 x 10^9/L - 6.3 x 10^9/L), LYM 1.47 x 10^9/L (reference value 1.1 x 10^9/L - 3.2 x 10^9/L), MON 1.35 x 10^9/L (reference value 0.1 x 10^9/L - 0.6 x $10^{9/}$L), and improve the infection index tips: CRP 200 mg/L (reference value 0 mg/L - 8 mg/L), PCT 1.33 ng/mL (reference value 0 ng/mL - 0.05 ng/mL), IL-6 139.40 pg/mL (reference value 0 ng/mL - 0.05 ng/mL), ESR 53 mm/h (reference value 0 mm/hour - 15 mm/hour), fibrinogen 4.59 g/L (reference value 2 g/L - 4 g/L), no obvious abnormalities were found in biochemical detection. Repeated sputum finding acid-fast bacilli was negative. Chest CT scan revealed multiple patchy high-density lesions in both lungs, locally increased density in the lower lobe of the right lung, bronchiectasis in both lungs, with fluid levels visible in both lower lungs, and hypodilation of the lower lobe of the right lung (Figure 1). We initially considered bronchiectasis with hemoptysis, and the etiology of infection suggested the presence of Pseudomonas aeruginosa, staphylococcus epidermidis, Aspergillus fumigatus, and candida albicans. Therefore, the patients were given anti-infective therapy with meropenam 1 g intravenous infusion every 8 hours, vancomycin 0.5 g intravenous infusion every 12 hours, and voliconazole 0.2 g intravenous infusion every 12 hours. At the same time, due to the need for the patient's condition, we initially improved percutaneous bronchial artery embolization, and the patient did not have hemoptysis after surgery. After 3 weeks of anti-infection treatment, the index of reexamination decreased slightly, but it was still at a high level. After a comprehensive assessment of the patient's condition, bronchoscopy was completed, and NGS of lavage fluid indicated the presence of mycobacterium abscess. Therefore, we revised the diagnosis to nontuberculous mycobacteriosis, and we administered antiinfective therapy with imipenem and citastatin 0.5 g intravenously every 8 hours, amikacin sulfate 0.6 g intravenously once daily, and azithromycin 0.5 g intravenously once daily. After 4 weeks of the above treatment, the infection index of the patient decreased compared to before. Reexamination of the chest CT scan showed that the patchy high-density shadow range of the lower lobe of the right lung decreased compared with before, and bronchiectasis was still seen in both lungs, mainly in the two lower lungs (Figure 2). After discharge, the patient continued regular treatment against non-tuberculosis mycobacteria.

DISCUSSION

For the discussion of the causes of hemoptysis, a good diagnosis and treatment process has been formed. However, when infection occurs in patients with hemoptysis, the search for pathogenic bacteria has become the focus of treatment. For this patient, although we initially obtained some infectious pathogens, anti-infection treatment had a certain effect, but the patient's condition was not significantly improved. At the same time, chest CT showed no significant changes in the infectious lesions of both lungs, and we considered that other special pathogens might exist. After bronchoscopy, lavage fluid pathology indicated the presence of acid-fast bacilli, and finally, NGS confirmed the presence of Mycobacterium abscessus infection.

Non-tuberculous Mycobacteria (NTM) are a group of pathogens present in the natural environment, including Mycobacterium abscessus avium complex and Mycobacterium abscessus complex, which are increasingly prevalent worldwide. These microorganisms are prone to cause lung infections in patients with structural lung disease, especially cystic fibrosis and other diseases associated with bronchiectasis [1,2]. The global burden of disease for NTM is largely unknown. As NTM is an opportunistic pathogen, it mainly causes diseases in patients with underlying lung diseases, including chronic obstructive pulmonary disease, cystic fibrosis, and bronchiectasis [3]. Recent studies have also shown that the incidence of lung infections caused by non-tuberculosis Mycobacterium abscessus infections is on the rise. According to a laboratory assessment from 1993 to 1996 performed by the Centers for Disease Control and Prevention, the rate of positive NTM cultures was 7.5 - 8.2 cases per 100,000 persons. However, a recent survey showed that among non-HIV patients in the United States, the positive culture rate was 17.7 per 100,000 [4]. Among them, the number of patients infected with Mycobacterium abscessus was less. Al-Houqani et al. demonstrated in a population-based study in Ontario, Canada, that non Mycobacterium tuberculosis pulmonary disease increased substantially with age; from 1 in 100,000 in people < 50 years old to 48 in 100,000 people over 79 years [5]. At the same time, elderly patients with non-tuberculous Mycobacterium infection, such as Mycobacterium abscessus, often present with asymptomatic infection, or with pre-existing lung disease, so it is easy to misdiagnose. The patient mainly presented with hemoptysis in the early stage, which was initially considered to be related only to bronchiectasis. Despite repeated negative sputum smears for acid-fast bacilli, non-tuberculous mycobacterial infections can still be easily overlooked.

Mycobacterium abscessus is a non-tuberculous mycobacterium whose ability to cause disease increases exponentially, which changes the description of rapidly growing non-tuberculous mycobacteria [6]. Mycobacterium abscessus is the most virulent rapid-growing mycobacterium and the cause of most lung infections caus-

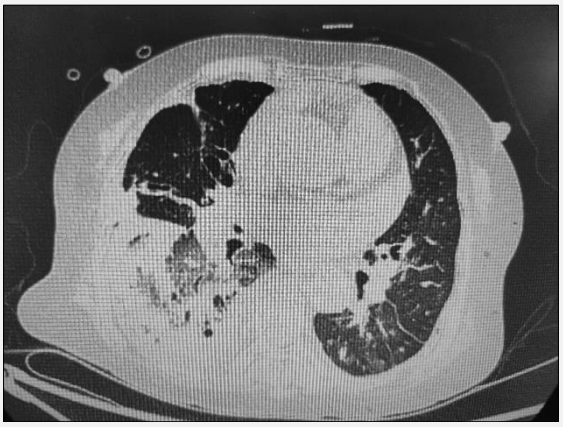

Figure 1. Multiple patchy high-density lesions in both lungs, localized increase in the density of the lower lobe of the right lung.

Bronchiectasis in both lungs, with fluid level visible in part, right lower lobe inflation.

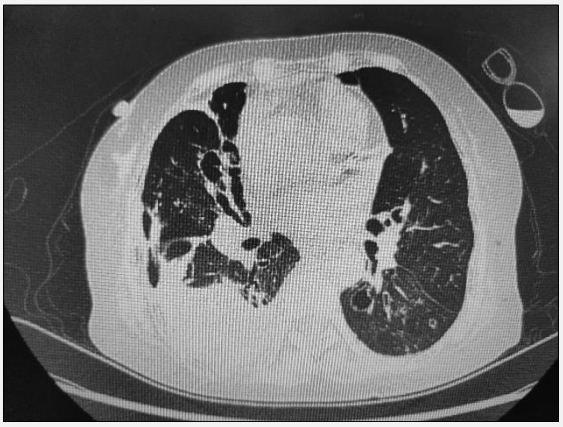

Figure 2. After 4 weeks of anti-abscess mycobacterium treatment, chest CT scan showed that the patchy high-density shadow of the lower lobe of the right lung was smaller than before, and bronchiectasis was still seen in both lungs, especially in both lower lungs.

ed by rapid-growing mycobacteria [7]. Among non-tuberculous mycobacteria, Mycobacterium abscessus can cause some of the most serious and difficult-to-treat infections, especially chronic lung infections [8]. The outer surface of Mycobacterium abscessus is hydrophobic, leading to biofilm formation and resistance to disinfectants and antibiotics. This bacterium is also associated with biofilm formation, resistance to disinfectants, high temperatures, and acidic environments. Therefore, Mycobacterium abscessus is one of the most resistant microorganisms to chemotherapy drugs, and its main threat as a human pathogen is its high resistance to multiple drugs, which is very difficult to treat [9].

At present, the treatment of non-tuberculous mycobacteria, including Mycobacterium abscessus, is largely based on antibiotic cocktail therapy, which is prolonged and often accompanied by serious adverse reactions [10, 11]. Despite the longer treatment time, the sputum culture conversion rate is still less than 50% [12]. As a result, infection with mycobacterium abscessus imposes a

huge economic burden on patients, with studies showing that approximately $815 million was spent on non-tuberculosis infections in the United States in 2010 [13]. In addition, none of the commonly used treatment options are safe, well-tolerated, or effective.

Currently, antibiotics that mycobacterium abscessus is sensitive to include amikacin, cefoxitin, imipenem, clarithromycin, linezolid, doxycycline, tigecycline, ciprofloxacin, and moxifloxacin [14]. For patients who are sensitive to macrolide antibiotics, amikacin, imipenem and citastatin sodium, clarithromycin/azithromycin are recommended in the initial stage, and macrolide antibiotics, linezolid, minocycline, quinolone antibiotics, rifampentine/Clofazimine/cotrimoxazole are recommended in the extended stage, and at least 1 year after continuous sputum culture and negative treatment [15]. For this patient, after 4 weeks of application of amikacin, imipenem citastatin sodium, and azithromycin in the initial stage against Mycobacterium abscessus infection, the infection indicators were significantly improved, although the thoracic imaging showed no obvious improvement in the multiple patellar high-density lesions in both lungs, which may be due to imaging hysteresis. Meanwhile, the patient was older and the recovery period was longer.

CONCLUSION

Our case shows that for the subsequent infection in patients with hemoptysis and the poor treatment effect of antibiotics, it is necessary to be alert to the presence of special bacteria such as Mycobacterium abscessus. If necessary, early bronchoscopy or percutaneous pulmonary puncture biopsy should be performed to make a clear diagnosis, and the corresponding treatment plan should be customized at the early stage of the disease process. This will ultimately reduce morbidity, and length of hospital stay and improve quality of life.

Acknowledgment:
We would like to thank other members of the Department of Respiratory Medicine, Affiliated Hospital of the North China University of Technology for the constructive criticism.

Ethical Approval:
This study was approved by the ethics committee of North China University of Science and Technology Affiliated Hospital. All procedures performed in studies were in accordance with the ethical standards. Informed consent was obtained.

Declaration of Interest:
No conflicts of interest.

References:

1. Chandrashekaran S, Escalante P, Kennedy CC. Mycobacterium abscessus disease in lung transplant recipients: Diagnosis and management. J Clin Tuberc Other Mycobact Dis 2017 Dec;9:10-8. (PMID: 29276785)
2. Friedman DZP, Doucette K. Mycobacteria: Selection of Transplant Candidates and Post-lung Transplant Outcomes. Semin Respir Crit Care Med 2021 Jun;42(3):460-70. (PMID: 34030207)
3. Stout JE, Koh WJ, Yew WW. Update on pulmonary disease due to non-tuberculous mycobacteria. Int J Infect Dis 2016 Apr;45: 123-34. (PMID: 26976549)
4. Verma AK, Arora VK. Non-tuberculous mycobacterial infections in geriatric patients-A neglected and emerging problem. Indian J Tuberc 2022;69 Suppl 2:S235-S240. (PMID: 36400516)
5. Al-Houqani M, Jamieson F, Mehta M, Chedore P, May K, Marras TK. Aging, COPD, and other risk factors do not explain the increased prevalence of pulmonary Mycobacterium avium complex in Ontario. Chest 2012 Jan;141(1):190-7. (PMID: 21724552)
6. Johansen MD, Herrmann JL, Kremer L. Non-tuberculous mycobacteria and the rise of Mycobacterium abscessus. Nat Rev Microbiol 2020 Jul;18(7):392-407. (PMID: 32086501)
7. To K, Cao R, Yegiazaryan A, Owens J, Venketaraman V. General Overview of Nontuberculous Mycobacteria Opportunistic Pathogens: Mycobacterium avium and Mycobacterium abscessus. J Clin Med 2020 Aug 6;9(8):2541. (PMID: 32781595)
8. Bar-Oz M, Meir M, Barkan D. Virulence-Associated Secretion in Mycobacterium abscessus. Front Immunol 2022 Jul 8;13:938895. (PMID: 35880173)
9. Nessar R, Cambau E, Reyrat JM, Murray A, Gicquel B. Mycobacterium abscessus: a new antibiotic nightmare. J Antimicrob Chemother 2012 Apr;67(4):810-8. (PMID: 22290346)
10. Pennington KM, Vu A, Challener D, et al. Approach to the diagnosis and treatment of non-tuberculous mycobacterial disease. J Clin Tuberc Other Mycobact Dis 2021 May 8;24:100244. (PMID: 34036184)
11. Kumar K, Daley CL, Griffith DE, Loebinger MR. Management of Mycobacterium avium complex and Mycobacterium abscessus pulmonary disease: therapeutic advances and emerging treatments. Eur Respir Rev 2022 Feb 9;31(163):210212. (PMID: 35140106)
12. Wu ML, Aziz DB, Dartois V, Dick T. NTM drug discovery: status, gaps and the way forward. Drug Discov Today 2018 Aug; 23(8):1502-19. (PMID: 29635026)
13. Strollo SE, Adjemian J, Adjemian MK, Prevots DR. The Burden of Pulmonary Nontuberculous Mycobacterial Disease in the United States. Ann Am Thorac Soc 2015 Oct;12(10):1458-64. (PMID: 26214350)
14. Daley CL, Iaccarino JM, Lange C, et al. Treatment of nontuberculous mycobacterial pulmonary disease: an official ATS/ERS/ESCMID/IDSA clinical practice guideline. Eur Respir J 2020 Jul 7;56(1):2000535. (PMID: 32636299)
15. Wu J, Lu AD, Zhang LP, Zuo YX, Jia YP. [Study of clinical outcome and prognosis in pediatric core binding factor-acute myeloid leukemia]. Zhonghua Xue Ye Xue Za Zhi 2019 Jan 14;40(1): 52-7. (PMID: 30704229)