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CASE REPORT

Mycobacterium porcinum Infection of Hilar and Mediastinal Lymph Nodes: A Case Report and Literature Review

Wenjie Wei*, Renrui Luo*, Zhikui Chen, Jianbin He

Department of Respiratory and Critical Care Medicine, Hunan University of Medicine General Hospital, Huaihua, People's Republic of China

*These authors contributed equally to this work

Correspondence: Jianbin He, Department of Respiratory and Critical Care Medicine, Hunan University of Medicine General Hospital, Jinxi South Road 144, Hecheng District, Huaihua, 418000, People's Republic of China, Email hjb0919@aliyun.com

Abstract: In the available reports on clinical medicine, the infection sites of *Mycobacterium porcinum* include wounds, bone marrow, respiratory tract, and catheters. A 61-year-old woman was admitted to our hospital; her hilar and mediastinal lymph nodes were found to be enlarged during health examination, but there was no specific discomfort. Initially, she had undergone a mediastinal lymph node biopsy and pathology, but the diagnosis was not confirmed. However, 16S rRNA gene sequencing revealed *M. porcinum* infection of hilar and mediastinal lymph nodes. Subsequently, she was treated with clarithromycin, amikacin, imipenem, and tigecycline. After 2 months, chest computed tomography showed a significant reduction in lymph nodes. *M*. porcinum infection was considered to be the cause of disease.

Keywords: Mycobacterium porcinum, hilar, mediastinal, lymph nodes, infection

Introduction

Mycobacterium porcinum is a nontuberculous mycobacterium within the *Mycobacterium fortuitum* complex. *M. porcinum* is a fast-growing branching bacterium that can cause skin, soft tissue, respiratory, bone marrow, and catheter-related infections.[1,2] Patients infected with *M. porcinum* often have immune system abnormalities, it can occur in healthy individuals. With the advancements in medical testing methods, molecular technology has greatly improved the detection of microorganisms. Here, we have described a case of *M*. porcinum infection of the hilar and mediastinal lymph nodes diagnosed by sequencing technologies.

Case Report

A woman in her sixties without any symptoms participated in a health screening organized by her workplace in the early 2023. Chest computed tomography (CT) revealed multiple enlarged lymph nodes in the bilateral hilar and mediastinal regions. As the patient had no chronic diseases and currently did not experience any discomfort such as fever, cough, or phlegm, watchful waiting was suggested, and follow-up one month later. On follow-up, a contrast-enhanced CT scan was performed, which demonstrated that the mediastinal and hilar lymph nodes were still enlarged (Figure 1). To determine the cause, the attending outpatient doctor admitted the patient to the hospital.

Upon admission, the patient was examined comprehensively for tumors, tuberculosis, nontuberculous mycobacteria, fungi, viruses, and for other relevant differential diagnoses. Only the neuron-specific enolase (NSE) and galactomannan GM) antigen tests demonstrated a slight increase in the levels, NSE 22.66 ng/mL and GM 0.5379 ug/L (NSE 0–16.3 ng/mL, GM <0.25 ug/L). Subsequently, on March 7, 2023, the patient underwent an ultrasound bronchoscopy examination, which did not reveal any new growths. Endobronchial ultrasound detected enlarged lymph nodes in station 7, which

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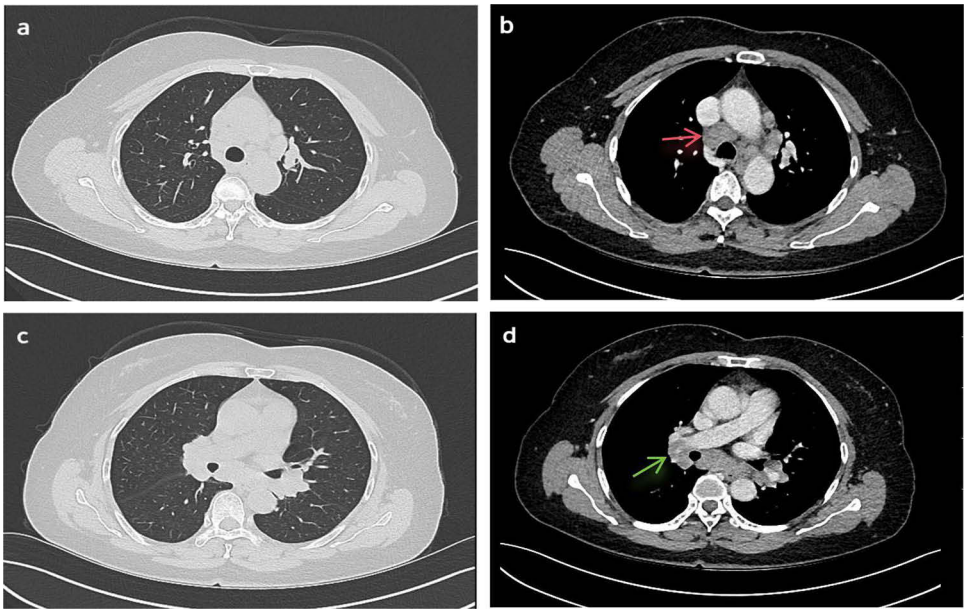

Figure 1 Chest CT showing enlarged (**a** and **b**) mediastinal (red arrows) and (**c** and **d**) hilar lymph nodes (green arrows) before treatment.

measured 13.9×19.9 mm. A biopsy was performed at the site, and bronchoalveolar lavage fluid was collected for testing. The result of the fluid testing showed no abnormalities, but hematoxylin and eosin staining of station 7 lymph nodes suggested granulomatous inflammation. After excluding tuberculosis, sarcoidosis was considered (Figure 2). Owing to the possibility of errors and subjectivity in pathological slides, Pathological specimens were sent for a second opinion but resulted in same conclusion. However, the findings were the same as our hospital's pathological results. The diagnosis remained unclear, but considering that the patient did not experience any specific discomfort, regular follow-up appointments at our clinic without any treatment were recommended for the time being. The patient was discharged.

In March, 2023, the patient was reexamined at our outpatient clinic. After a discussion with the patient, wax blocks of the 7th group of lymph node tissues were sent for gene sequencing to SAGENE, a testing company in Changsha. The report signified a positive result for *M. porcinum*. Based on comprehensive examinations of the patient, the possibility of *M. porcinum* infection in the mediastinal and hilar lymph nodes was considered. Based on the findings, the patient was subsequently treated with clarithromycin (500 mg, BID), amikacin (15 mg/kg, QD), imipenem (1 g, BID), and tigecycline (50 mg, BID). In April, the patient left the city owing to family reasons and failed to report for review,

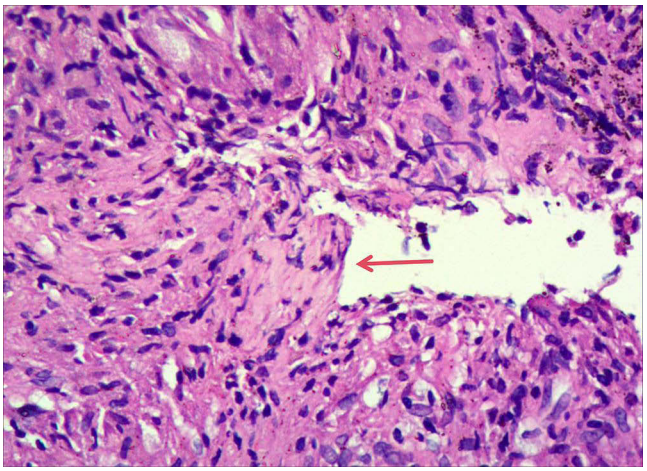

Figure 2 Hematoxylin-eosin staining of the mediastinal lymph nodes (10 × 20) exhibiting granulomatous inflammation (red arrow).

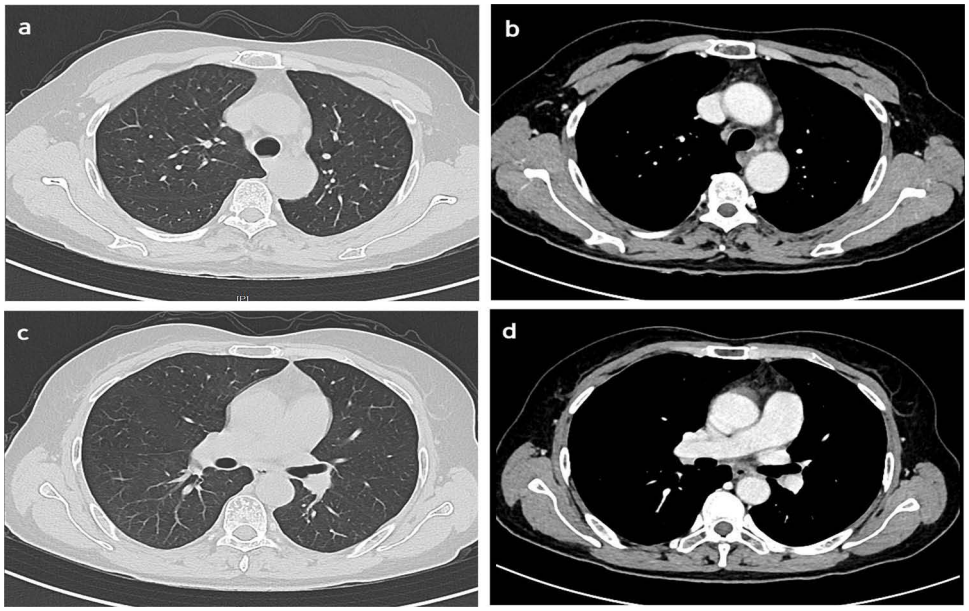

Figure 3 After more than 1 month of the treatment, the follow-up chest CT exhibited reduced mediastinal (**a** and **b**) and hilar (**c** and **d**) lymph nodes relative to that before the treatment.

but according to a telephonic follow-up, treatment was continued as per the original protocol. In May, the patient returned for examination, and CT showed that the hilar and mediastinal lymph nodes were smaller than earlier (Figure 3), which indicated the effectiveness of the treatment.

Discussion

M. porcinum is a rare nontuberculous mycobacterium that was initially identified in 1983 in the mandibular lymph nodes of pigs with tuberculosis-like infections.[3] Only in 2004, *M. porcinum* was identified as a human pathogen using molecular techniques,[4] and only a few cases have been reported so far. *M. porcinum* is a gram-positive acid-fast bacillus and a fast-growing mycobacterium. This bacillus can grow on egg medium after 3 days of incubation at 28°C, 37°C, and 42°C.[5] The organism is present in water sources and spreads via tap water, drinking water, and water distribution systems, among other modes. Dissemination via contamination of water with any pollutant is also possible and can even cause serious nosocomial infections.[6] The pathogenesis is mainly due to cell-mediated immunity and delayed-type hypersensitivity mediated by $CD4^+$ T cells.[7] Various cytokines, such as interferon-γ, interleukin-12, and tumor necrosis factor-α, are involved, thus contributing to granuloma formation and may even lead to tissue necrosis and cavity formation.[8]

A review of previous cases (n = 6) suggests that *M. porcinum* infections mostly occur in postoperative wounds, soft tissues, skin, and bone marrow. Catheter-related infections[9,10] are also possible (Table 1), and infected individuals may have a history of exposure to contaminated water sources.[11] In this case, the patient did not exhibit any clinical symptoms and was admitted to the hospital because of enlarged hilar and mediastinal lymph nodes found on chest CT during physical examination. Tumor-related, fungal, or tuberculosis-related tests performed after the admission did not yield any positive results, which made early diagnosis difficult. It is worth noting that in previous cases, the secretions of most patients had been positive for acid-fast staining. We conducted bacteriological culture, genetic testing of Mycobacterium tuberculosis, and CEA in the BAL fluid, However, because tuberculosis and NTM were not considered by the attending physician at that time, tuberculosis culture was not completed.This might have been an important factor affecting early and correct diagnosis. With the advancements in molecular diagnostic techniques, the homologous gene or sequence comparison method has become the current "golden standard" for strain identification. This method focuses on the identification of bacteria at the species level by analyzing differences in the composition of homologous DNA sequences. This method holds immense significance in the clinical diagnosis of infectious diseases. Sequences commonly used in

Table 1 Review of the Literature on Reported Cases of *M. Porcinum* Infection

Ref.	Gender	Age	Diseases	Sites Involved	Presentation	Diagnosis approach	Antimicrobial	Outcome
Patil[15]	Female	67	End-stage renal disease on continuous ambulatory peritoneal dialysis	Abdomen	Malaise, lethargy, poor appetite, low-grade fever (98–99°F) with night sweats and abdominal discomfort	Peritoneal fluid culture	Ciprofloxacin, trimethoprim-sulfamethoxazole-DS BID	Improvement
Wang[9]	male	66	Rupture of an open wound about the inner side of the mid-shaft tibia-fibula right lower leg	Wound of the lower right leg	Healed wound at the medial lower right leg and the wound at the right knee joint surgery incision began to bleed with ulceration and pus	MALDI-TOF-MS, 16S rRNA gene sequencing identification	Cefoxitin, amikacin, doxycycline	Improvement
Ade ´kambi[16]	female	31	Open right tibia fracture	Bone	Wound opened and wound liquid began to out-flow	16S rRNA gene sequencing identification	No report	No report
Idigoras[17]	male	78	Coronary artery bypass surgery was performed through sternotomy	Sternum	No report	16S rRNA gene sequencing identification	ciprofloxacin	Improvement

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Table 2 Differentiation of Lymph Node Nontuberculous Mycobacteria Infection from Pulmonary Sarcoidosis

	Presentation	Chest CT	Pathological Features	Diagnostic Criteria
Lymph node nontuberculous mycobacteria infection	No systemic symptoms and signs, only local lymph node involvement, and possibly mild tenderness that could rapidly progress into lung infection.[20]	Multiple mediastinal and hilar lymph nodes were enlarged, most being asymmetrical and accompanied by pulmonary infectious lesions.[21]	In the early stage, the granulomas were composed mainly of lymphoid cells, epithelioid cells, and Langerhans cells, and caseous necrosis could be formed rapidly.[22]	Mycobacteria are detected by isolation, culture, genetic sequencing, and other techniques.[20]
Pulmonary sarcoidosis	Possibly no symptoms in the early stage; the later stage can present with chest tightness, cough, hemoptysis, fever, night sweats, and other symptoms.[23]	Bilateral hilar lymphadenectasis is diffuse and symmetrical; in severe cases, it may be accompanied by diffuse pulmonary fibrosis or honeycomb lung formation.[23]	The lesions are uniformly distributed and well-circumscribed, presenting as a noncaseating granuloma.[23,24]	Corresponding clinical and imaging features and pathological outcomes suggest noncaseating granuloma, while other similar diseases are excluded.[25]

this method are the identification of *Mycobacterium* spp. include the 16S ribosomal RNA, the 16S–23S rRNA internal transcribed spacer, the β subunit of RNA polymerase, and the gene encoding heat shock protein 65.[12–14] In most of the cases reported in recent years, the detection of *M. porcinum* has relied chiefly on molecular techniques.

Initially, during testing, there was no provisional basis for intrapulmonary infection because no obvious lesions were seen in the patient's lungs. Therefore, genetic sequencing of alveolar lavage fluid was not performed, and pathological examination was directly refined. However, both nontuberculous and tuberculous mycobacterial infections are pathologically visible as granulomas and are therefore difficult to differentiate. Furthermore, pulmonary sarcoidosis was a key point that had to be identified in this patient. Stage 0–1 pulmonary sarcoidosis does not exhibit any symptoms, and only hilar lymphadenopathy is observed on CT, which is quite similar to the situation of this patient. Moreover, pulmonary sarcoidosis can also be manifested in the form of granulomas pathologically, but the disease cannot be diagnosed unless other diseases are completely excluded (Table 2). Differential diagnoses need to be ruled out sequentially to prevent misdiagnoses. Unlike previous cases, a sample from the present case was sent to the laboratory for examination of mediastinal lymph node tissue. However, in previous cases, secretions from the infected area, such as pus and ascites, were the most common. In addition, it has been well documented that *M. porcinum* most often infects the lung and is then transmitted to the mediastinal lymph nodes.[18,19] Only mediastinal lymph node infections have not been reported so far. Our finding suggests that molecular diagnostic testing of infected tissues should not be omitted.

Nowadays, *M. porcinum* infection is mostly treated according to the *M. fortuitum* treatment protocol, which varies from site to site. Nevertheless, the main therapeutic agents are amikacin, clarithromycin, quinolones (ciprofloxacin, moxifloxacin, etc.), tetracyclines, etc.[26] The mode, dosage, and duration of administration are adjusted according to the patient's condition. Patients with lung infections are advised to stop the medication 1 year after the review during which the sputum turns negative. In case of skin and soft-tissue infections, a treatment course of at least 4 months is recommended. For patients with bone disease, the course of treatment is a minimum of 6 months,[7,15] and most patients achieve good results with this therapy.

Conclusion

M. porcinum infections are very rare in clinical practice. These infections are more common in individuals who had been in contact with contaminated water as well as in immunocompromised individuals. Patients with lymph node infection may not exhibit any symptoms in the early stage and are often ignored or misdiagnosed as pulmonary sarcoidosis. Hence, it is important to improve the clinician's knowledge of this pathogen and the disease. Genetic techniques are now widely employed in the diagnosis of clinical infectious diseases and have immensely improved the detection of pathogens. It is

important to note, however, that a proper analysis of the disease is imperative to enable healthcare professionals to make appropriate use of this technology.

Ethics Approval and Consent for Publication

This study has been reviewed and approved by the Research Ethics Committee of the First People's Hospital of Huaihua. The patient provided informed consent for publication of the clinical details, including lung CT images, and written informed consent was obtained. Written informed consent was provided by the patient for the publication of the case details and images. Details of the case can be published without institutional approval.

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Disclosure

The authors report no conflicts of interest in this work.

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