Proceedings of Anticancer Research, 2024, Volume 8, Issue 5
http://ojs.bbwpublisher.com/index.php/PAR
ISSN Online: 2208-3553
ISSN Print: 2208-3545

A Case of *Lautropia mirabilis* Infection in a Lung Transplant Patient and a Review of the Literature

Jinqian Liu[1†], Kaijin Wang[2*†], Qingdi Xia[2], Bicui Liu[2], Yishan Dong[1], Haiyan Cen[1], Shujun Yi[1]

[1]Chongqing University Jiangjin Hospital, Chongqing 402760, China
[2]Chongqing Medical University Bishan Hospital, Chongqing 402760, China
[†]These authors contributed equally to this work.

***Corresponding author:** Kaijin Wang, 523488033@qq.com

Abstract: *Lautropia mirabilis* is an opportunistic pathogen that typically causes intestinal and oral infections when the body's immune system is compromised or the microbial flora is imbalanced. Respiratory infections caused by *Lautropia mirabilis* are extremely rare. The symptoms and severity of *Lautropia mirabilis* infection may vary depending on individual differences and the site of infection. Through a review of relevant literature and this case study, it has been observed that *Lautropia mirabilis* may also cause pulmonary infectious diseases, and in immunocompromised patients, it can lead to severe infections, potentially resulting in death.

Keywords: *Lautropia mirabilis*; Lung transplant; Infection; Literature review

Online publication: September 25, 2024

1. Introduction

Lautropia mirabilis consists of coccoid bodies at various developmental stages, aggregated on a common surface layer, and is described as Gram-negative irregular spherical cells [1]. Currently, there are few studies on this pathogen, both domestically and internationally. This study presents a case of *Lautropia mirabilis* infection in a lung transplant patient treated at the hospital, along with a review of the literature.

2. Case information

The patient, Mr. Lai, male, 58 years old, was admitted to the hospital due to "cough and sputum production for more than 10 days, worsening for 2 days." Over six years ago, the patient underwent a right single-lung transplant for "interstitial lung disease" at another hospital and has been on post-operative oral anti-rejection medication (tacrolimus 2 mg orally four times a day, CellCept 4 tablets orally four times a day).

Temperature: 36.5°C, pulse: 88 bpm, respiratory rate: 20 breaths/min, blood pressure: 118/70 mmHg. The patient appeared lethargic, with signs of acute illness, rapid breathing, mild cyanosis of the lips, and no jugular

vein distension. The chest was symmetrical, with slightly coarse breath sounds in both lungs. Noticeable moist rales were heard in the left lung, especially at the bases of both lungs. No wheezing was detected, and there was no edema in the lower limbs.

C-reactive protein: 41.88 mg/L, white blood cell count: 3.14 × 10^9/L, neutrophil percentage: 80.30%, creatinine: 155 μmol/L. Arterial blood gas analysis: partial pressure of carbon dioxide (PCO_2): 30 mmHg, partial pressure of oxygen (PO_2): 88 mmHg. Chest computed tomography (CT): scattered, patchy ground-glass opacities in both lungs, with a high suspicion of viral pneumonia. Interstitial changes in the left lung. Slightly enlarged cardiac silhouette, small pericardial effusion, and bilateral pleural thickening (**Figure 1**). Antiviral treatment with Azvudine and anti-infective treatment with piperacillin-tazobactam were initiated.

Five days later, the patient's respiratory distress showed little improvement. A repeat arterial blood gas test revealed: pH: 7.42, PCO_2: 32 mmHg, PO_2: 63 mmHg (with nasal cannula oxygen). Antibiotics were switched to meropenem for anti-infective therapy. However, the condition did not improve significantly, and non-invasive mechanical ventilation was initiated [inspiratory positive airways pressure (IPAP): 16.0, expiratory positive airways pressure: 6.0, respiratory rate: 20 breaths/min, the maximum time it will spend in IPAP: 1.4 s, the minimum time it will spend in IPAP: 0.5 s, rise time: 300 ms, tidal volume: 480–500 mL, peripheral oxygen saturation: 95%]. Despite treatment, the patient continued to experience pronounced dyspnea, and signs of septic shock, such as blood pressure drops, appeared. A repeat chest CT showed increased patchy ground-glass opacities in both lungs, highly suggestive of viral pneumonia, with interstitial changes in the left lung. Compared to the chest CT on January 1, 2023, the lesions had significantly increased, and a small amount of new left pleural effusion was noted. The cardiac silhouette was slightly enlarged, with a small pericardial effusion and bilateral pleural thickening. There was also evidence of an old right rib fracture (**Figure 2**).

White blood cell count: 30.11 × 10^9/L. Both Gram-negative bacilli and Gram-positive cocci were detected, and bedside lavage was performed. BALF-NGS indicated *Lautropia mirabilis* with a sequence count of 8912 (**Table 1**). The patient was immediately intubated and placed on invasive mechanical ventilation. A bedside chest X-ray was repeated (**Figure 4**), and antibiotics were switched to a combination of imipenem-cilastatin, cefoperazone-sulbactam, and voriconazole for anti-infective treatment. Norepinephrine was administered to maintain blood pressure, and the patient continued on invasive mechanical ventilation. On the 15th day of admission, the patient experienced cardiac arrest and was pronounced dead.

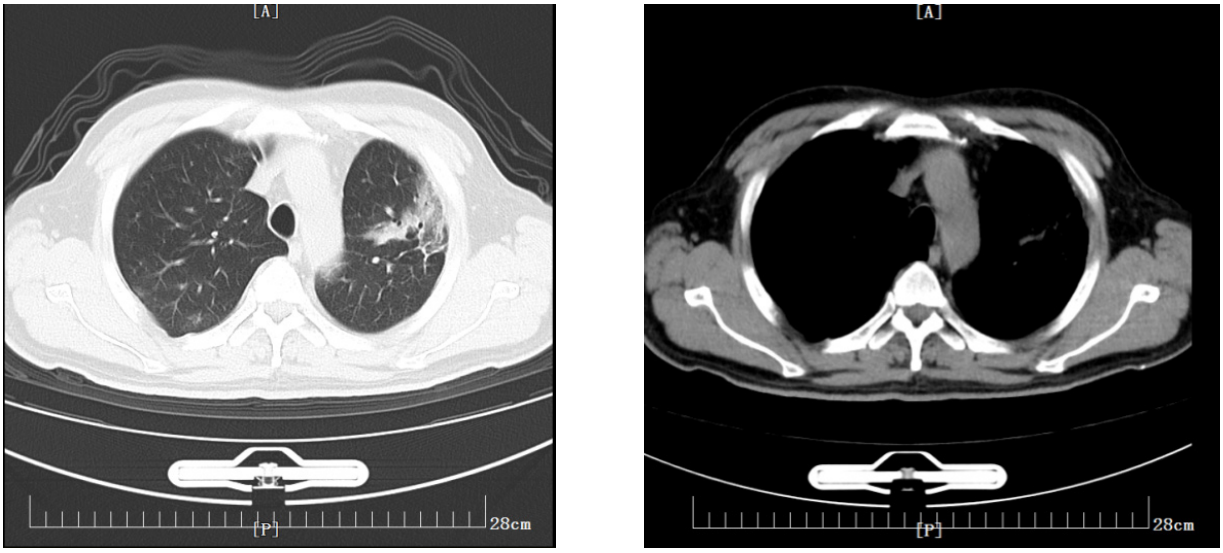

Figure 1. Chest CT upon admission. **(Left)** Lung window: consolidation and ground-glass opacities in the upper lobe of the left lung; **(Right)** Mediastinal window: consolidation visible

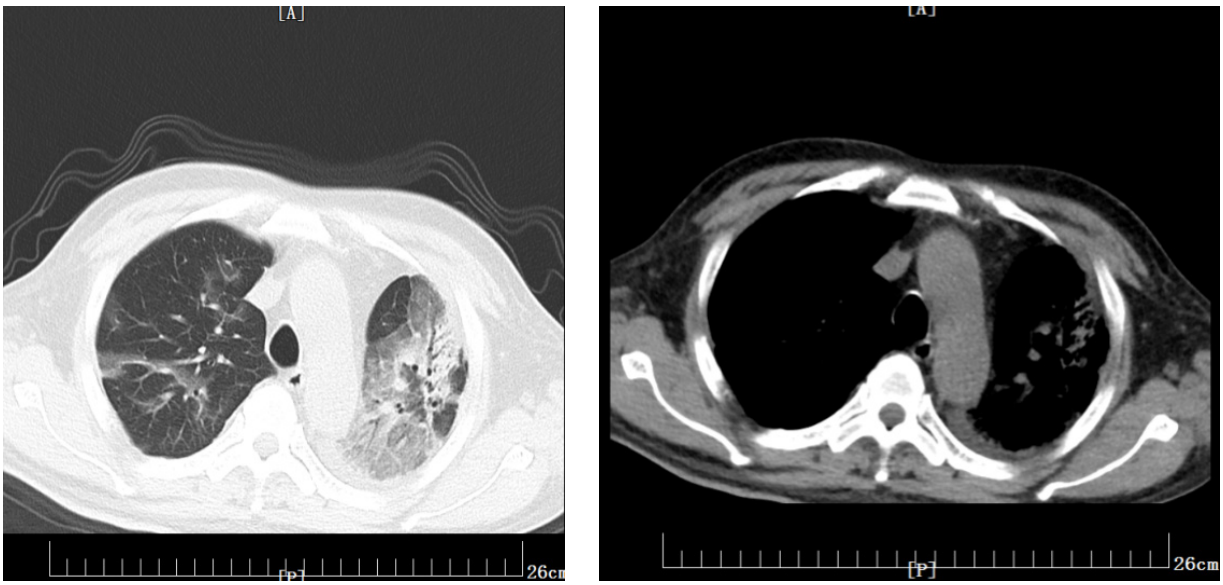

Figure 2. Repeat chest CT. **(Left)** Lung window: increased consolidation and ground-glass opacities in the upper lobe of the left lung; **(Right)** Mediastinal window: increased consolidation

Table 1. BALF-NGS indicated *Lautropia mirabilis*

Bacteria						
Genus				Species		
Type	Name	Sequence number	Relative abundance %	Name	Sequence number	Relative abundance %
G -	Lautropia	8912	80.98	Lautropia mirabilis	8912	80.98

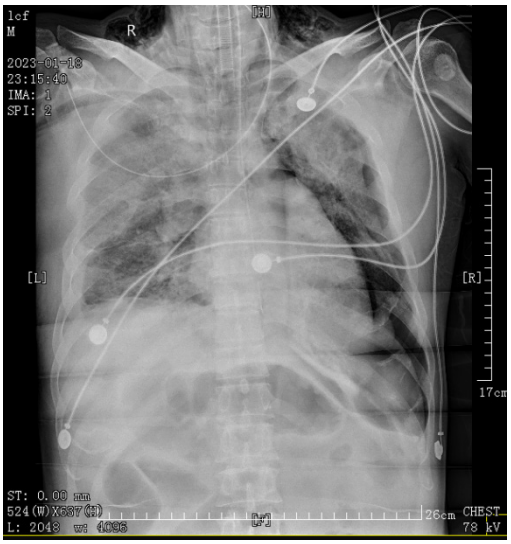

Figure 3. ICU repeat bedside chest X-ray: multiple consolidations and ground-glass opacities in both lungs

3. Discussion

Lautropia mirabilis consists of coccoid bodies at various stages, aggregated on a common surface layer, and is characterized by irregular spherical Gram-negative cells. Under Gram staining, the morphology is different from common bacteria, presenting as relatively large spherical cells that are not easily emulsified and tend to aggregate, often leading to mistaken identification as impurities. This bacterium is positive for oxidase, catalase,

urease, glucose, and maltose, but negative for lactose, sucrose, phenylalanine deaminase, and indole. Preliminary identification can be made based on morphology and key biochemical reactions in routine laboratory work. *Lautropia mirabilis* is widely distributed in nature, as well as in the intestines of humans and animals [2]. It is an opportunistic pathogen, meaning that under normal circumstances, it does not cause disease in the human intestines. However, when the immune system is compromised or microbial flora becomes imbalanced, it can cause intestinal or oral infections, although respiratory infections caused by this bacterium are extremely rare [3]. The symptoms and severity of *Lautropia mirabilis* infections can vary depending on individual differences and the infection site. In some cases, it may present without noticeable symptoms, while in specific populations or infection sites, it may cause significant illness. This case shows that *Lautropia mirabilis* can also lead to pulmonary infectious diseases, and in immunocompromised patients, it can cause severe infections and even death.

Regarding the pathogens responsible for infections in lung transplant patients, literature reports that the long-term prognosis and survival rates at 1, 3, and 5 years post-transplant are 66.1%, 56.3%, and 36.2%, respectively. During follow-up, five fatal infections were confirmed, three occurring within 30 days post-transplant, one between 2 and 12 months, and one after 1 year. Of these fatal pulmonary infections, two involved Gram-negative bacterial coinfections with septic shock, two were fungal infections with associated candidemia, and one case was CMV pneumonia [4]. To date, there have been no reported cases of *Lautropia mirabilis* infections leading to death. However, in this case, the patient, who had undergone a right single-lung transplant six years earlier, died from *Lautropia mirabilis* infection. There have been reports of Lautropia mirabilis breaching the oral mucosal barrier and causing oral mucositis, even leading to bloodstream dissemination and sepsis in immunocompromised patients on extensive antibiotic therapies, such as glycopeptides and β-lactams [5]. This patient had been on long-term immunosuppressants following the lung transplant, compounded by left lung IPF, which led to repeated infections and hospitalizations. Before this current infection, the patient had been hospitalized multiple times for lung infections and treated with piperacillin-tazobactam and other β-lactam antibiotics, which may have contributed to the Lautropia mirabilis infection [1].

Lautropia mirabilis was first described in 1994 by Gerne-Smidt [1], and in 1997, it was detected twice in the sputum of a patient with cystic fibrosis. In a screening of 500 sputum samples from cystic fibrosis patients, 12% tested positive for *Lautropia mirabilis*. Large quantities of *Lautropia mirabilis* have been isolated from the oral cavities of children infected with HIV, and its role in oral and periodontal diseases in HIV-infected individuals requires further investigation. The bacterium has also been isolated from blood and sterile body fluids, suggesting that it may cause invasive diseases [4]. *Lautropia mirabilis*-induced oral mucositis typically presents as painful oral ulcers, and when systemic infection occurs, patients may develop high fever, chills, and, in some cases, septic shock. In this case, the infection primarily presented with respiratory symptoms, including dyspnea and the production of scant, white sputum. Laboratory findings showed elevated white blood cell counts, severe hypoxemia, and later-stage acute heart failure, with symptoms including orthopnea and bilateral leg edema. Blood pressure gradually decreased, and the patient developed septic shock. Imaging findings on CT mainly showed consolidation and exudative changes, with rapid progression of pulmonary imaging, although the radiological features were not distinctive.

The post-lung transplant infection rate is 74% (37/50), with 9 cases (24.3%) of single-pathogen infections and 28 cases (75.7%) of mixed infections involving two or more pathogens. The main causative pathogens are Gram-negative bacteria (*Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Stenotrophomonas maltophilia*, and *Klebsiella pneumoniae*), with resistance rates for *Pseudomonas aeruginosa* to cephalosporins, fluoroquinolones, and trimethoprim-sulfamethoxazole ranging from 66.7% to 94.1%. *Acinetobacter baumannii* exhibited high resistance to multiple antibiotics, with resistance rates of 72.7% to 100%. The resistance rate of *Stenotrophomonas maltophilia* to ceftazidime was 50%, and *Klebsiella pneumoniae* showed resistance rates of 44.4% to 71.4% against

carbapenems, β-lactams, cephalosporins, and fluoroquinolones. Gram-positive bacteria, such as *Staphylococcus aureus*, *Streptococcus hemolyticus*, and *Enterococcus faecalis*, were also isolated, with good sensitivity to linezolid, daptomycin, tigecycline, and vancomycin, which can be considered as first-line treatments [6].

Lautropia mirabilis consists of coccoid bodies at different stages, aggregated on a common surface layer, and presents as irregular spherical Gram-negative cells. Regarding the treatment of *Lautropia mirabilis*, the literature suggests that antibiotics such as ampicillin or cefotaxime may be effective. For patients allergic to these drugs, aminoglycosides or chloramphenicol may be alternatives. In severe infections, combination therapy may be required. In this case, the patient received anti-infective treatment with cefoperazone-sulbactam, voriconazole, and imipenem-cilastatin, but the outcome was poor.

Infections with *Lautropia mirabilis* are rare in lung transplant patients. Due to immunosuppression and concurrent COVID-19 infection, early diagnosis and treatment are crucial, as many patients had already received β-lactam antibiotics before their hospital visits. Immunocompromised individuals may be more susceptible to *Lautropia mirabilis*. To prevent infection, maintaining good personal hygiene, such as frequent handwashing and avoiding sharing personal items, is important. Additionally, regular physical exercise and a healthy lifestyle can help boost immunity and reduce the risk of infection. Clinicians should raise awareness of this bacterium, as early detection, diagnosis, and treatment are closely related to patient outcomes in lung transplant recipients infected with *Lautropia mirabilis*.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Gerner-Smidt P, Keiser-Nielsen H, Dorsch M, et al., 1994, Lautropia mirabilis gen. nov., sp. nov., A Gram-Negative Motile Coccus with Unusual Morphology Isolated from the Human Mouth. Microbiology (Reading), 140(Pt 7): 1787–1797. https://doi.org/10.1099/13500872-140-7-1787

[2] Li S, Pan Y, Weng W, et al., 2015, Analysis of Epidemiological, Aetiological, and Prognostic Factors of Lung Infection After Lung Transplantation. Chinese Clinical Journal of Thoracic and Cardiovascular Surgery, 22(10): 948–953.

[3] Muro M, Soga Y, Higuchi T, et al., 2018, Unusual Oral Mucosal Microbiota After Hematopoietic Cell Transplantation with Glycopeptide Antibiotics: Potential Association with Pathophysiology of Oral Mucositis. Folia Microbiol (Praha), 63(5): 587–597. https://doi.org/10.1007/s12223-018-0596-1

[4] Lin Y, Lin J, Chen F, 2018, Isolation and Identification of A Strain of Lautropia mirabilis in Respiratory Specimens. Journal of Clinical Investigation, 36(10): 795–797.

[5] Rossmann SN, Wilson PH, Hicks J, et al., 1998, Isolation of Lautropia mirabilis from Oral Cavities of Human Immunodeficiency Virus-Infected Children. J Clin Microbiol, 36(6): 1756–1760. https://doi.org/10.1128/JCM.36.6.1756-1760.1998

[6] Xu S, Lou J, 2021, Distribution and Drug Resistance Characteristics of Pathogenic Bacterial Infections and Risk Factors After Lung Transplantation. Proceedings of the 2021 China Tumour Marker Academic Conference and the 15th Tumour Marker Young Scientist Forum, 2021: 2.