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CORRESPONDENCE

Successful salvage therapy with micafungin for *Candida* empyema thoracis

Dear Editor,

We read with great interest the article by Lin et al[1] in the *Journal of Microbiology, Immunology and Infection* in which they reported that *Candida* empyema thoracis is a serious complication of invasive candidiasis and has a high mortality. The success rate of fluconazole treatment remains uncertain. *Candida albicans* is the most common etiology of fungal empyema thoracis. However, the golden standard treatment for it is controversial. In this paper, we report a patient who was diagnosed as having nosocomial *Candida* empyema thoracis with acute respiratory failure. He initially received multiple thoracocenteses and fluconazole therapy for 14 days, but fever and pleural effusion persisted (Fig. 1A). He could not be weaned from the ventilator smoothly. For salvage therapy, we changed from fluconazole to micafungin (100 mg) intravenous (iv) drip every 24 hours. Thereafter, he was successfully weaned from the ventilator. After a 21-day course of micafungin treatment, chest X-ray imaging revealed an improvement (Fig. 1B).

The patient, a 91-year-old male, had a history of bladder adenocarcinoma, stage T4N2M0, status postoperation and postradiotherapy. He also had chronic obstructive pulmonary disease, coronary artery disease postoperation, and an old stroke. He was admitted to the hospital because of fever, dyspnea, and drowsy consciousness. On admission, laboratory data showed a hemoglobin level of 9.6 mg/dL; white blood cell count, 17,330 cells/mL; and platelet count, 214,000 cells/mL. Routine urine examination revealed pyuria and bacteriuria. The arterial blood gas showed a pH of 7.175; $PaCO_2$, 17.0 mmHg; PaO_2, 76.1 mmHg; and HCO_3^-, 6.1 mmol/L. He was admitted to the intensive care unit because of metabolic acidosis, acute respiratory failure, and urosepsis. During hospitalization, he received multiple broad-spectrum antibiotic therapies for the urinary tract infection and ventilator-associated pneumonia. Sixteen days later, chest X-ray imaging showed left-sided pleural effusion. Pleural fluid analysis revealed a lactate dehydrogenase level of 163 U/L (serum, 200 U/L) and a white blood count of 14800/mL with 87% neutrophils and 13% mononuclear cells. Cultures of the sputum, pleural fluid, blood, and the tip of the central venous catheter (CVC) all showed *C. albicans*. Therefore, the CVC was removed, and he received fluconazole (800 mg iv drip stat and 600 mg iv drip every 24 hours) for *Candida* empyema thoracis and bloodstream infection. Concurrent with this treatment, he received multiple thoracocenteses for drainage. The antifungal agent was replaced by micafungin because of treatment failure with fluconazole. After a 21-day course of antifungal therapy, the patient was weaned successfully from the ventilator and micafungin was discontinued.

Invasive candidiasis has increasingly emerged as an important hospital-acquired infection, especially in critical and immunocompromised patients.[1–4] The most common sites of *Candida* infections are the urinary tract, bloodstream, and bronchopulmonary system.[2] Fungal empyema thoracis is rare, but its crude mortality is high (61.9–73%).[1–2] Lin et al[1] and Ko et al[2] report that the most common fungal isolates recovered from the pleural fluid is *C. albicans*, followed by *Candida tropicalis*, *Candida glabrata*, and *Aspergillus* species.[1–2] The pathogenesis of *Candida* empyema thoracis is by contiguous spreading or noncontiguous spreading to the pleural space.[1–4] The most common underlying disease of *Candida* empyema thoracis is a malignancy.[1] Many patients acquire it in intensive care units.[2] The reported major causes of fungal empyema thoracis include previous abdominal surgery, gastrointestinal perforation, bronchopulmonary infections, chest surgery, and bloodstream infections. Our patient's case may have resulted from pulmonary *Candida* infection and CVC-related candidemia.

Adequate drug penetration into the pleural cavity is crucial for successful antifungal treatment. Only a few

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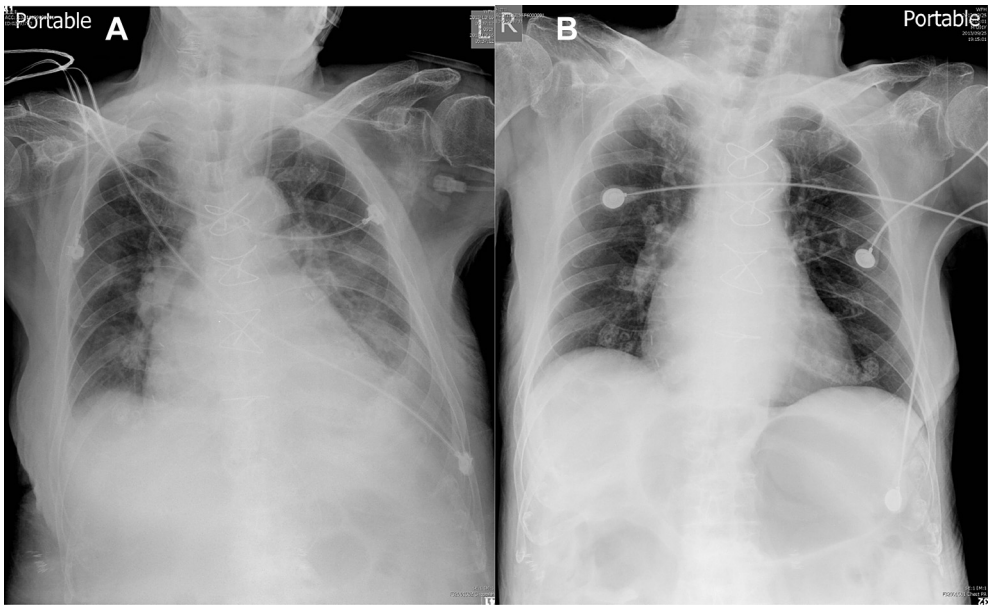

Figure 1. (A) Chest X-ray reveals cardiomegaly and left side pleural effusion. (B) Chest X-ray shows markedly decreased pleural effusion after thoracocentesis and micafungin therapy.

studies exist regarding the penetration of antifungal agents into the pleural effusion. Matsuda et al[5] used high-performance liquid chromatography to measure the micafungin and voriconazole concentrations in the plasma and in the pleural fluid of a patient with fungal empyema thoracis. They found that the penetration ratio of micafungin was 57—68% and that of voriconazole was 45—95%. The pleural surface is thicker and more acidic in patients with empyema. Pleural diffusion of antimicrobial agents is highly variable.[6] The concentration of micafungin is high and that the concentration of micafungin is at a proper therapeutic level. It also has a greater ability to penetrate the biofilm of the pleural cavity, compared to fluconazole.[5] These two advantages may contribute to its successful treatment of fungal empyema.[5] For treatment-refractory patients with *Candida* empyema thoracis, salvage therapy with micafungin may be an alternative treatment.

Ethics approval

Ethics approval was not required for this study.

Conflicts of interest

The authors have no competing interests to declare.

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