Introduction

Septic pulmonary embolism (SPE) is a rare diagnosis that presents with nonspecific symptoms such as fever, cough, sputum, pleuritic chest pain, but has a high mortality [1]. Predisposing conditions such as infective endocarditis, i.v. drug addiction, venous catheter, tonsillitis, oropharyngeal abscess, peripheral septic thrombophlebitis (Lemierre’s syndrome) accompany SPE [2]. In the pathogenesis of SPE, inflammation caused by translocation of the microorganism from the primary focus of infection to the venous system, endothelial damage, and thrombogenic toxins produced by the microorganism cause thrombosis. Thrombus leads to infarcts and multiple abscesses where it goes. In patients presenting with fever and nonspecific symptoms and accompanied by a predisposing condition such as the presence of an intravascular catheter, the detection of bilateral nodular and/or cavitary lesions in thorax computed tomography (CT), which are signs of feeding vessels in the lungs. Here, we present a case of SPE with a hemodialysis catheter and clinical findings of sepsis, which was referred to our center with a preliminary diagnosis of tuberculosis.

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Keywords
Septic pulmonary embolism · Bilateral nodules · Venous catheter

Abstract

Septic pulmonary embolism (SPE) is a rare lung disease that typically occurs when a thrombus containing microorganisms from a nonpulmonary infection focus settles in the pulmonary arteries via the hematogenous route and causes infarction and infection. Nonspecific symptoms such as fever, cough, and chest pain are manifested. SPE is associated with predisposing conditions such as infective endocarditis, intravenous drug addiction, venous catheter, tonsillitis, and tooth and pelvis infections. It has high morbidity and mortality, and the most important point that determines the prognosis is early diagnosis and broad-spectrum antibiotic therapy in the early phase. SPE should be considered when the primary focus of infection is accompanied by high fever and multiple nodules and/or cavitary lesions, which are signs of feeding vessels in the lungs. Here, we present a case of SPE with a hemodialysis catheter and clinical findings of sepsis, which was referred to our center with a preliminary diagnosis of tuberculosis.
Case Report

A 42-year-old female with symptoms of cough, fever, and shortness of breath was referred to the tuberculosis service with a preliminary diagnosis of tuberculosis after bilateral cavitary lesions were found in the thorax CT taken at an external center. The medical history of the patient indicated that she had been in the hemodialysis program (3 times/week, capillary dialyzer, synthetic high flux membrane [500 mL/dk Kt/V = 1.0], calcium carbonate tablets according to the blood result) for 2 years due to a diagnosis of chronic renal failure and had COVID-19 9 months ago. The general condition of the patient was moderate, conscious, cooperative, and oriented; body temperature was 39°C, heart rate was 118 beat per minute, blood pressure was 115/75 mm Hg, respiratory rate was 26 per min, and saturation was 93%. On physical examination, there were bilateral rales and pretibial edema. The patient had a right jugular indwelling catheter; C-reactive protein 153 mg/L, sedimentation 64 mm/h, procalcitonin 58.73 ng/mL, white blood cell 30,700/μL, hemoglobin 94 g/L, sodium 125 mmol/L, and other parameters were normal. On thorax CT, there was pleural effusion on the right and bilateral multiple cavities and nodules accompanied by findings of feeding vessels (Fig. 1, 2). The case was suspected to have a SPE, an infectious disease specialist was consulted, and she was started on meropenem and tigecycline. The blood cultures and acid-fast bacillus (AFB) and complete cultures of deep tracheal aspiration (DTA) were requested. The patient had clinical signs of sepsis (lactate: 5.6 mmol/L) and was transferred to the intensive care unit (ICU) on the day she was hospitalized. Continuous renal replacement therapy was started in ICU. The desaturated patient was intubated and connected to a mechanical ventilator. The patient died on the 4th day of her ICU stay. AFB direct look of DTA was negative; there is no growth in AFB blood cul-

Fig. 1. Thorax CT: bilateral multiple nodules and cavities.

Fig. 2. A sign of feeding vessel in thorax CT.
tures. There was no growth in nonspecific and fungal cultures and AFB cultures of DTA, but there was penicillin-resistant (levomoxifloxacin-sensitive) *Staphylococcus aureus* growth in two different blood cultures.

**Discussion/Conclusion**

SPE is a rare lung disease characterized by infection, infarction, and bilateral nodule and/or cavity in the lung parenchyma as a result of a microorganism-containing thrombus embolizing into the venous circulation and settling in the pulmonary arteries. Intravenous drug use, infective endocarditis, intravascular catheters, hemodialysis, pacemaker, periodontal abscess, and liver abscess are among the reasons that cause SPE [3]. Its clinical presentation may range from nonspecific symptoms such as fever, cough, sputum, and pleuritic chest pain to acute sepsis [4]. Therefore, it is difficult to diagnose, and hence, the diagnosis of the disease may be delayed. The diagnosis is mostly made with the presence of clinical findings associated with the infection, the presence of predisposing factors, and CT findings. Thorax CT is superior to chest X-ray in both diagnosis and differential diagnosis [5]. Typical CT findings may include nodules and/or cavities located mostly in the area close to peripheral vessel terminations (a sign of feeding vessel; Fig. 2), infiltrates, wedge-shaped lesions adjacent to the pleura, pleural effusion, focal consolidation, and abscess [6–8]. The most critical factor for disease prognosis is to consider SPE and start broad-spectrum antibiotic therapy early [3–5]. This case, who was referred with an initial diagnosis of tuberculosis due to cavitary lung lesions and whose empirical antibiotic therapy was delayed at the time of referral, was presented together with the literature to highlight SPE in the differential diagnosis of multiple cavi
ties and to draw attention to the removal of the catheter, which is thought to be the source of infection, and to the initiation of early antibiotic therapy.

SPE should be considered when the primary focus of infection is found to be accompanied by high fever and nodules and/or cavities located in the area close to the multiple peripheral vessel endings in the lungs. While the finding of a feeding vessel indicates that the lesion is of hematogenous origin, the presence of cavitation is an indicator of infarction [5]. Although these findings support the SPE diagnosis, they can also be seen in other lung diseases. However, the feeding vessel sign is very sensitive for SPE.

The differential diagnosis of cavitary nodules includes lung cancer, tuberculosis, hydatid cysts, fungal infections, necrotizing pneumonia, Wegener’s granulomatosis, and rheumatological diseases such as rheumatoid arthritis. Rapid cavitation of nodules in SPE helps differentiate it from malignancy. Cavitary lesions dominant on the peripheral lower lobe, randomly distributed, and having a feeding vessel sign, in particular, support the SPE diagnosis as in our case, while cavitary lesions in the upper lobe apical region, consolidation, tree-in-bud pattern, and galaxy sign can be considered to indicate tuberculosis [7].

Treatment principles for SPE include early intravenous broad-spectrum antibiotic therapy and removal of potential sources of infection (such as intravenous catheters). In SPE, mortality is between 10 and 20% and is mainly caused by septic shock and multi-organ failure [3–6].

In conclusion, SPE is a rare disease with high mortality. In patients presenting with fever and nonspecific symptoms and who have a predisposing condition such as the presence of an intravascular catheter, the detection of bilateral nodules and/or cavitations with a feeding vessel sign on thorax CT should remind SPE. Early diagnosis and timely treatment determine the disease prognosis.

**Statement of Ethics**

Appropriate informed consent was obtained in accordance with the Declaration of Helsinki. Ethics Committee approval is not required for case reports in our country. It is considered sufficient to obtain consent from the patient’s relatives. For the publication of the article, permission was obtained from the relatives of the medical case (husband) for figures, images, photographs, texts, and other materials belonging to the patient to be used in the case report.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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**Author Contributions**

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**Data Availability Statement**

The data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.
References

1. Chou DW, Wu SL, Chung KM, Han SC, Cheung BMH. Septic pulmonary embolism requiring critical care: clinicoradiological spectrum, causative pathogens and outcomes. Clinics. 2016;71(10):562–9.

2. Inchaustegui CA, Wang KY, Teniola O, De Rosen VL. Large septic pulmonary embolus complicating streptococcus mutans pulmonary valve endocarditis. J Radiol Case Rep. 2018 Feb 28;12(2):18–27.

3. Ye R, Zhao L, Wang C, Wu X, Yan H. Clinical characteristics of septic pulmonary embolism in adults: a systematic review. Respir Med. 2014 Jan;108(1):1–8.

4. Goswami U, Brenes JA, Punjabi GV, LeClaire MM, Williams DN. Associations and outcomes of septic pulmonary embolism. Open Respir Med J. 2014;8:28–33.

5. Karadeniz G, Polat G, Üçsular F, Vayısoğlu G, Yalnız E, Doruk S. Septic pulmonary embolism. Respir Case Rep. 2017;6(3):153–6.

6. Dodd JD, Souza CA, Müller NL. High-resolution MDCT of pulmonary septic embolism: evaluation of the feeding vessel sign. AJR Am J Roentgenol. 2006 Sep;187(3):623–9.

7. Parkar AP, Kandiah P. Differential diagnosis of cavitary lung lesions. J Belg Soc Radiol. 2016;100(1):100.

8. Tale S, Ghosh S, Pahel Meitei S, Kolli M, Garbhapu AK. Feeding vessel sign: a radiological sign of septic pulmonary embolism. QJM. 2021 May 19;114(3):213–4.