

## Idiopathic methicillin-susceptible *Staphylococcus aureus* associated tricuspid valve endocarditis and pneumothorax in a patient without apparent predisposing factor: a case report

Mohammad Dashtkoohi<sup>1†</sup>, Farbod Semnani<sup>1†</sup>, Nasser Aghdami<sup>2,3</sup>, Marjan Sohrabi<sup>3\*</sup>, Arezoo Salami Khaneshan<sup>3</sup>, Fereshte Ghasvand<sup>3</sup>, Parnian Adhami Moghadam<sup>4</sup>

<sup>1</sup>Students' Scientific Research Center (SSRC), Tehran University of Medical Sciences, Tehran, Iran

<sup>2</sup>Department of Regenerative Medicine, Cell Science Research Center, Royan Institute for Stem Cell Biology and Technology, ACECR, Tehran, Iran

<sup>3</sup>Department of Infectious Diseases and Tropical Medicines, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran

<sup>4</sup>Department of Infectious Diseases and Tropical Medicines, Islamic Azad University of Medical Sciences, Tehran, Iran

Received: September 2022, Accepted: November 2022

### ABSTRACT

Pneumothorax following right-sided bacterial endocarditis is an infrequent medical complication usually reported in cases with a history of intravenous drug abuse. The following report describes the condition of a girl without congenital heart disease or a history of intravenous drug abuse who developed pneumothorax secondary to endocarditis.

**Keywords:** Bacteremia; Bacterial endocarditis; Empyema; Pneumothorax; *Staphylococcus aureus*

### INTRODUCTION

Right-sided bacterial endocarditis (RSBE) includes 5-10% of all infective endocarditis (IE). Its incidence is increased by the presence of predisposition factors, such as intravenous drug abuse, intracardiac devices, and central venous catheters. RSBE has remarkably different manifestations and complications from left-sided IE. *Staphylococcus aureus* is the responsible pathogen of 60-90% of RSBE, which usually result in valvular insufficiency, septic pulmonary, and abscess formation (1). However, it seems that this pathogen can cause rare complications, bi-

lateral pneumothorax, and pneumothorax secondary to IE, for instance (2). This report will describe a case of RSBE that resulted in the development of pneumothorax without any apparent predisposing factor.

### CASE PRESENTATION

A 15-year-old-female was admitted to the Imam Khomeini Hospital, the infectious disease ward with prolonged fever, moderate dyspnea, and pleuritic chest pain. Her condition began with intermittent fever (every two days) and chills after injection

<sup>†</sup>These authors contributed equally to this work.

\*Corresponding author: Marjan Sohrabi, MD, Department of Infectious Diseases and Tropical Medicines, Imam Khomeini Hospital Complex, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-9123447107 Fax: +98-66581615 Email: msohrabi@sina.tums.ac.ir; sky98194@gmail.com

of the DT vaccine a month prior. She was suspected of COVID-19 due to a prolonged fever and non-productive cough after two weeks; thus, symptomatic therapy for COVID-19 and additional therapy with azithromycin 250 mg daily was initiated accordingly. Her status remained unchanged, and she was referred to Imam Khomeini Hospital. Her medical history showed no intravenous drug abuse, smoking, alcohol consumption, surgical operation, recent dental procedures, catheterization, congenital heart disease, immunosuppressive therapy, and travels, as well as exposure to any specific medications (apart from the DT vaccine) in the recent past.

On physical examination, she was a girl with a height of 169 cm and a weight of 53 kilograms, agitated, conscious, and febrile at 39.1°C. She had a pulse rate of 160/min, respiratory rate of 27/min, blood pressure of 120/65 mmHg, and a SpO<sub>2</sub> of 98. Contrary to the patient's poor oral hygiene, any evidence of gingivitis, decayed teeth, or pharyngitis was not observed. Reduced respiratory sounds and a 3/6 heart murmur on the tricuspid valve were noted. She did not have any rashes or skin lesions on her body. Laboratory data and the progress of her condition are summarized and depicted in Fig. 1.

The primary electrocardiogram was normal except for sinus tachycardia, and the COVID-19 PCR result was negative. Nevertheless, spiral chest computed tomography demonstrated numerous periferal nodules throughout the lungs, occasionally with a cavitary pattern, compatible with septic emboli (Fig. 2).

Immediately after taking blood samples for culture (3 two-bottle blood cultures, separated with at least a 2-hour period, and taken from different venipuncture sites), empirical antibiotic therapy consisting of ampicillin-sulbactam 3 g IV QID and vancomycin 1 g BD was initiated. The results of blood cultures were reported as negative.

Simultaneously, the patient underwent trans-thoracic echocardiography, the results of which were inconclusive. Transesophageal echocardiography was postponed because of the instability of the patient's condition. Despite her persistent tachycardia and low blood pressure, chest computed tomography angiography and lower limb color doppler sonography did not show any deep vein thrombosis or acute pulmonary thromboembolism. She was promptly transferred to the ICU due to a complaint of mild to moderate respiratory distress; then, a left-sided chest tube was administered. Her symptoms improved almost

instantly afterward. Subsequently, trans-esophageal echocardiography discovered two mobile masses with a total size of 14 mm by 14 mm consistent with vegetation on the atrial side of the tricuspid valve, predominantly on the anterior septal leaflets, and severe associated tricuspid regurgitation was noted.

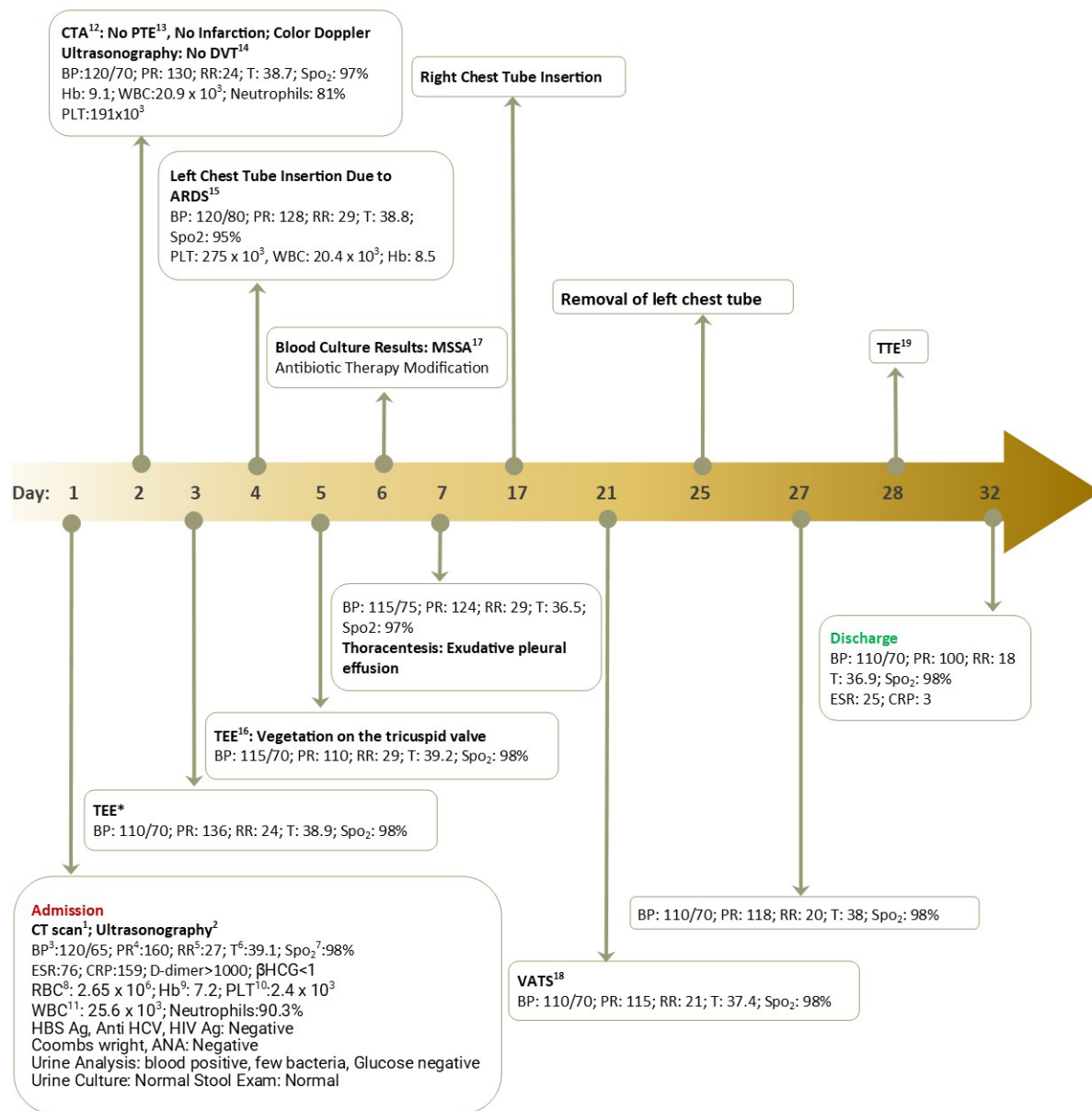
After six days of empirical therapy, the blood culture was positive with the growth of methicillin-susceptible *Staphylococcus aureus* (MSSA). It was a single positive blood culture bottle (SPBCB) with all the following cultures reported as negative. Considering MSSA-attributed- endocarditis infecting native valves, cefazolin 2 g IV q8h was started. The fever disappeared on the very first day afterward. Pleural fluid from thoracentesis had a bloody turbid appearance, with a lab analysis compatible with empyema. Pleural fluid culture and smear were reported to be negative after several Gram-stain tests. After more than a week of follow-up, severe right hydro-pneumothorax with a resultant collapse of the right lung, mediastinal shift to the other side, and a moderate left pleural effusion was observed (Fig. 3). Right chest tube was inserted successfully.

Subsequently, the patient underwent decortication of the pleura via video-assisted thoracoscopic surgery, and fibrin and clots were removed successfully. Follow-up was performed as the patient experienced a single-time self-limited fever. Except for the diminished size of vegetation (5 mm by 11 mm), other results were unremarkable. Eventually, the patient was discharged after four weeks of antibiotic therapy with cephazolin.

Informed consent was obtained from the patient's legal guardian (biological mother) for reporting the patient's condition.

## DISCUSSION

Known predisposing factors for RSBE are intravenous drug abuse, intracardiac devices, a history of central venous catheters, and congenital heart malformations (3). Pneumothorax develops due to RSBE is a very uncommon complication. Still, it seems it is more likely to occur in patients with intravenous drug abuse history (2, 4-6). Moreover, our case had a single positive blood culture bottle (SPBCB) with *Staphylococcus aureus* and it was six days after the initiation of empirical therapy. Then the antimicrobial regime was changed to cephazolin. Shortly af-

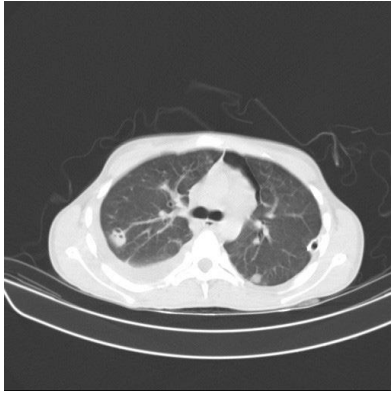


**Fig. 1.** Description of the performed procedures and the progress of the patient from admission to discharge. 1) Computed tomography scan of the chest; 2) Abdominal and pelvic sonography; 3) Blood pressure; 4) Pulse rate; 5) Respiratory rate; 6) Temperature (°C); 7) Saturation of peripheral oxygen; 8) Red blood cell count; 9) Hemoglobin (g/dL); 10) Platelets count; 11) White Blood cell count; 12) Computed Tomography Angiography; 13) Pulmonary Thromboembolism; 14) Deep Vein Thrombosis; 15) Acute Respiratory Distress Syndrome; 16) Transesophageal Echocardiogram; 17) Methicillin-sensitive *Staphylococcus aureus*; 18) Video-assisted Thoracoscopic Surgery; 19) Transthoracic Echocardiogram \*Inconclusive.

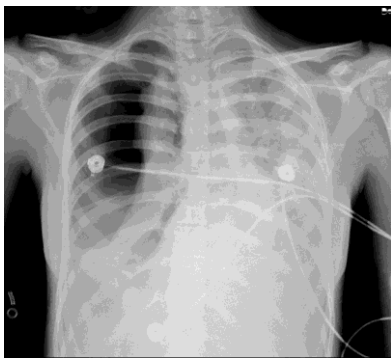
ter, left-sided thoracentesis was done and the fever disappeared. It may implicate that the patient's rapid response to treatment was due to the thoracentesis rather than changing the antimicrobial regime. Because vancomycin and cefazolin both effected mssa and change of AB to comply stewardship the cultures which were taken two days later and several times after that were reported negative. Regarding the low

incidence of contamination with MSSA (7) and the favorable response of the endocarditis to treatment (high clinical significance), we believe it is either because of the site of sampling, the transient entity of bacteremia, or the concurrent antimicrobial therapy that the cultures were reported negative afterward.

The reported case in focus did not have any previous record of intravenous drug injection. Swaminath



**Fig. 2.** Spiral chest CT. Diffuse nodules often present with a thin-walled cavity in favor of septic emboli. Mild pneumothorax of the left lung is also noted.



**Fig. 3.** Severe hydro-pneumothorax on the right side with collapse of the right lung, mediastinal left shift and moderate pleural effusion on the left side were noted.

et al. reported a case similar to the case in focus in 2013 in which the grown pathogen in blood culture was methicillin-sensitive *Staphylococcus aureus*. However, it was different from the ongoing case from two perspectives; first, their patient had an IE in the pulmonary valve. The second difference was that their case had a history of intravenous drug abuse (8).

In another case by Toprak C et al. a history of chest tube insertion eight days before the start of fever was responsible for RSBE (9). Yang SF et al. presented a case that developed pneumothorax due to IE, with a history of a tunneled cuffed catheter, a condition in which pneumothorax is more probably seen (10). The closest report to our case, where there seems to be no predisposing factor for IE and pneumothorax, was an eight-year-old boy reported by Lamblin A and his colleagues. Their case had a one-month fever, otitis media, and left thigh osteoarthritis that eventually caused endocarditis and a right pneumothorax. Like

ours, it had tricuspid valve vegetation and severe tricuspid regurgitation (11). Although we did several workups to find the primary source of infection, we failed to find a definite site of infection. However, due to the symptoms and signs of patients, an upper respiratory infection can be suspected.

REFERENCES

1. Shmueli H, Thomas F, Flint N, Setia G, Janjic A, Siegel RJ. Right-sided infective endocarditis 2020: challenges and updates in diagnosis and treatment. *J Am Heart Assoc* 2020; 9(15): e017293.
2. Galili Y, Lytle M, Carlan S, Madruga M. Bilateral pneumothoraces: a rare complication of septic pulmonary emboli in intravenous drug abusers. *Am J Case Rep* 2018; 19: 829-832.
3. Moss R, Munt B. Injection drug use and right sided endocarditis. *Heart* 2003; 89: 577-581.
4. Alafify AA, Al-Khuwaitir TS, Wani BA, Taifur SM. *Staphylococcus aureus* endocarditis complicated by bilateral pneumothorax. *Saudi Med J* 2006; 27: 707-710.
5. Corzo JE, Lozano De León F, Gómez-Mateos J, López-Cortes L, Vázquez R, García-Bragado F. Pneumothorax secondary to septic pulmonary emboli in tricuspid endocarditis. *Thorax* 1992; 47: 1080-1081.
6. Sheu C-C, Hwang J-J, Tsai J-R, Wang T-H, Chong I-W, Huang M-S. Spontaneous pneumothorax as a complication of septic pulmonary embolism in an intravenous drug user: a case report. *Kaohsiung J Med Sci* 2006; 22: 89-93.
7. Go JR, Challener D, Corsini Campioli C, Sohail MR, Palraj R, Baddour LM, et al. Clinical significance of *Staphylococcus aureus* in a single positive blood culture bottle. *Open Forum Infect Dis* 2021; 9: ofab642.
8. Swaminath D, Yaqub Y, Narayanan R, Paone RF, Nugent K, Arvandi A. Isolated pulmonary valve endocarditis complicated with septic emboli to the lung causing pneumothorax, pneumonia, and sepsis in an intravenous drug abuser. *J Investig Med High Impact Case Rep* 2013; 1: 2324709613514566.
9. Toprak C, Ozkan M, Koyuncu A, Kalcik M. Concomitant infection of the tricuspid valve and right ventricle free wall after chest tube insertion in a young patient without predisposing diseases. *Perfusion* 2014; 29: 275-277.
10. Yang SF, Yang WC, Lin CC. Infective endocarditis-related bilateral spontaneous pneumothorax in a haemodialysis patient. *Acta Clin Belg* 2012; 67: 51.
11. Lamblin A, Derkenne C. A child with fever, cough and Lancisi's sign. *Pan Afr Med J* 2018; 30: 14.