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Severe pneumonia treated by venovenous extracorporeal membrane oxygenation mistakenly entering the superior vena cava: A case report

Song XQ *et al*. Pneumonia treated by mistaken V-V ECMO

BACKGROUND

Venovenous extracorporeal membrane oxygenation (V-V ECMO) has become important for severe pneumonia, but there are various complications during the treatment. This article describes a successful case with severe pneumonia treated by V-V ECMO, but during treatment, the retrovenous catheter, which was supposed to be in the right internal vein, entered the superior vena cava directly in the mediastinum. The ECMO was safely removed after multidisciplinary consultation. Our experience in this case is expected to provide a reference for colleagues who will encounter similar situations.

CASE SUMMARY

A-64 year-old man had severe pulmonary infection and respiratory failure during. He was admitted to our hospital and was given ventilation support (fraction of inspired oxygen 100%). The respiratory failure was not improved and he was treated with V-V ECMO, during which, the retrovenous catheter, which was supposed to be in the right internal vein, entered the superior vena cava directly in the mediastinum. There was a risk of massive mediastinal bleeding if the catheter was removed directly when the ECMO was withdrawn. Finally, the patient underwent vena cava angiography + balloon attachment + ECMO extraction in our operating room (prepared for conversion to thoracotomy vascular exploration and repair at any time during surgery) after multidisciplinary consultation. ECMO was safely removed, and the patient recovered and was discharged.

CONCLUSION

Patients may have different vascular conditions. multidisciplinary cooperation can ensure patient safety. Our experience will provide reference for similar cases.

Key Words: Severe pneumonia; Extracorporeal membrane oxygenation; Complications; Superior vena cava; Multidisciplinary consultation; Case report

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Core Tip: Our paper provides a rare complication in the course of extracorporeal membrane oxygenation treatment, and the resolution mentioned in this article can provide a great reference for colleagues who encounter the same situation.

INTRODUCTION

Venovenous extracorporeal membrane oxygenation (V-V ECMO) has become a routine operation for the treatment of severe pneumonia that cannot be relieved by mechanical ventilation[1], but various complications during ECMO have been reported continuously, including hemorrhage, and incorrect catheter placement[2-4]. A patient with severe pneumonia complicated by H1N1 influenza virus was recently admitted to our department because of persistent hypoxia and was treated with V-V ECMO. A rare complication was that the blood return catheter should have been inserted into the right internal jugular vein but was mistakenly inserted into the superior vena cava. The patient finally recovered after intervention by a multidisciplinary team.

CASE PRESENTATION

Chief complaints

A 64-year-old man visited our hospital with cough and wheezing for 6 d, and fever for 1 d.

History of present illness

A 64-year-old man caught a cold on holiday. Symptoms were sneezing and coughing white sputum, but there was no chest pain or hemoptysis, and the patient was normothermic. The cough became worse and he began to wheeze and could not lie down at night, occasionally with blood in the sputum, with a fever of 38.5 ℃. Oral medication had no effect. When he arrived at our hospital, arterial oxygen saturation (SaO_2) was < 90% under mask oxygen, and chest computed tomography (CT) showed severe pulmonary infection (Figure 1). The patient was admitted to our respiratory intensive care unit (RICU) with mechanical ventilation on August 19, 2022.

History of past illness

No smoking history or other chronic disease history.

Personal and family history

The patient had no previous or family history of similar illnesses.

Physical examination

The patient weighed 70 kg, and his height was 170 cm; body temperature, 37 ℃; blood pressure, 153/101 mmHg; heart rate, 162 beats/min; respiratory rate, 36 breaths/min (ventilator); SaO_2 92% [fraction of inspired oxygen (FiO_2) 100%]; he was in a sedative state, and both lungs had audible dry and wet rales. No other positive signs were found during physical examination.

Laboratory examinations

Laboratory tests at the time of admission to the RICU were as follows: white blood cell count, 7.63 × 10^9/L (reference range, 4 × 10^9-10 × 10^9/L); neutrophil percentage, 89.9% (reference range, 50.0%-70.0%); procalcitonin, 12.62 ng/mL (reference range, < 0.05 ng/mL); C-reactive protein, > 200 mg/L (reference range, 0-5 ng/mL); arterial blood

gas pH, 7.21; arterial CO_2 pressure, 65 mmHg, arterial oxygen pressure, 80 mmHg; K^+, 3.3 mmol/L; glucose concentration, 15.4 mmol/L; and lactate, 3.1 mmol/L. No other abnormal results were found in routine blood biochemical analyses. The bronchoalveolar lavage fluid was collected on the day of admission and tested positive for influenza A.

Imaging examinations

Chest CT showed multiple inflammatory manifestations in both lungs (Figure 1).

FINAL DIAGNOSIS

The patient was diagnosed with severe pneumonia, respiratory failure, type A influenza, and electrolyte disturbance.

TREATMENT

The patient was admitted to the RICU in our hospital on August 19, 2022 due to cough and expiratory dyspnea for 6 d, complicated with fever of 38.5 °C for 1 d. Chest CT showed severe pneumonia in both lungs (Figure 1). After admission, the patient was given tracheal intubation and ventilator-assisted respiration, and because the pathogen was unknow, the anti-infective drugs were imipenem-cilastatin sodium, vancomycin, voriconazole, and oseltamivir. He was transferred to our Emergency ICU for V-V ECMO because of continuous hypoxia on the day of admission.

The right femoral vein blood drainage catheter and the right internal jugular vein blood return catheter under ultrasound localization were adopted in our operation. After catheterization, no catheter was found in the right internal jugular vein during routine ultrasound screening. The metallic catheter, which should have entered the right internal carotid artery, entered the superior vena cava directly in the mediastinum, which was confirmed by CT (Figure 2). Because the patient's condition was serious, we decided to let ECMO run its course, with a rotational speed of approximately 3900 r/min, blood flow approximately 5 L/min, FiO_2 100%, and blood oxygen saturation

increased to 100%. Follow-up treatments were adjusted according to the test results and the patient's condition during the entire ECMO process was normal.

On September 1, 2022, the patient reached the standard for ECMO withdrawal. Chest CT was performed again and image reconstruction was performed before withdrawal, which showed that the catheter used for blood retrieval was only 2 cm in the superior vena cava (Figure 3). The following questions were encountered: (1) Could the internal jugular vein catheter be removed directly and compressed to stop bleeding? (2) What would happen if there were more bleeding after the catheter was removed? Did we need to stop bleeding by thoracotomy? and (3) Was it necessary to directly open the chest and remove the catheter? In order to ensure the safe withdrawal of patients, our EICU organized multidisciplinary consultations including thoracic surgery, cardiac surgery, vascular surgery, interventional surgery and CT departments. Finally, two opinions were reached: (1) Advising transfer of the patient to a superior hospital; and (2) no transfer, and performing vena cava angiography + balloon attachment + ECMO extraction in our operating room (prepared for stent implantation, prepared for conversion to thoracotomy vascular exploration and repair at any time during surgery). We informed the family members of the consultative opinions, and the second opinion was followed.

On September 3, 2022, the patient was transferred to the operating room for ECMO withdrawal surgery. The operation process was as follows. The 21F ECMO catheter was cut at the right inguinal region, one super-hard guide wire was inserted to exchange the ECMO catheter, and guided by the pigtail catheter, reached the superior vena cava. Angiography performed through the pigtail catheter revealed where the ECMO catheter was located in the superior vena cava, and a 24 mm × 40 mm balloon was placed at the position of the ECMO catheter in the superior vena cava for standby, which along the guide wire that placed previously, then another guide wire and pigtail catheter were placed in reserve. We cut off the neck of the ECMO catheter, inserted a hard wire, replaced the neck ECMO catheter with a 14F Gore sheath for standby. The pressure pump filled the balloon, and the 14F sheath in the superior vena cava was

removed, but the neck guide wire was retained. Radiography through the second pigtail catheter showed that the balloon was blocked without obvious blood leakage. After the balloon was attached for 30 min, no extravasation of the contrast agent was found by multi-angle radiography. All equipment was removed and the procedure ended. The patient returned to the ward after the operation. The changes in red blood cells and hemoglobin in patients were monitored for 1 wk after the operation. No blood transfusion was required, and there was no obvious bleeding (Table 1).

OUTCOME AND FOLLOW-UP

In the later stage, the patient was successfully discharged from the ventilator after continuous anti-infective treatment, nutritional support, rehabilitation and other symptomatic treatment. He was discharged from the hospital on September 25, 2022 and returned to the local hospital for consolidation treatment for 1 wk. After 1 mo of follow-up, the patient recovered well without sequelae.

DISCUSSION

After technical improvement, V-V ECMO has played an increasingly important role in the treatment of severe pneumonia, especially since the COVID-19 pandemic[5]. There has been an increase in reports of various complications during the procedure, including catheter implantation, bleeding, and infection. The present case represents a situation that has not been reported before, and the patient was discharged safely after multidisciplinary collaboration. The following two factors should be considered to be related to our mistake: (1) Ultrasound positioning was not applied throughout the process, and errors occurred during puncture; and (2) the patient had a vascular malformation. There were small branch vessels between the internal jugular vein and the superior vena cava. The guide wire entered the branch vessels by mistake and directly entered the superior vena cava.

CONCLUSION

Differences in the vascular anatomy mean that there may be mistakes during V-V ECMO, but multidisciplinary collaboration can help keep patients safe by giving advice from different perspectives. Our experience in this case will provide a reference for similar situations in the future.

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Figure Legends

Table 1

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
RBC × 10^{12}/L	3.53	3.83	3.53	3.50	3.18	3.05	3.33
Hb (g/L)	105	112	102	101	92	90	98

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