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Point-of-care ultrasound (POCUS) to the rescue in VA-ECMO

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Point-of-care ultrasound (POCUS) is an established technique for the diagnosis and management of haemodynamic instability in critically ill patients, especially individuals after cardiac surgery and patients requiring mechanical circulatory support⁽¹⁾. We would like to share our recent encounter with unexplained haemodynamic instability in a patient on veno-arterial extracorporeal membrane oxygenation (VA-ECMO), and the critical role of POCUS in the rescue efforts.

A 40-year-old male presented to the emergency department at our institute with a history of ingesting an aluminium phosphide tablet (6.5 mg) six hours previously. After performing gastric lavage with potassium permanganate, he was transferred to the ICU on inotropic support. Bedside screening echocardiography revealed global hypokinesia with an ejection fraction of 20%. Given the increasing inotropic requirement, lactic acidosis, and irritability, invasive mechanical ventilation support was initiated. In collaboration with the cardiothoracic and vascular surgery (CTVS) department, the patient was scheduled for VA-ECMO. The left femoral artery and vein

were secured with 19 Fr and 27 Fr cannulas (Bio-Medicus, Eden Prairie, Minnesota, United States), respectively, and the patient was initiated on VA-ECMO at 3,100 rotations per minute to generate a cardiac output of 4 L/min and targeting the mean arterial pressure (MAP) of 60–65 mmHg. The venous cannula was positioned under transoesophageal echocardiographic (TEE) guidance, however the poor TEE window did not allow us to confirm the tip position and it was arbitrarily fixed at 50 cm. Over the next few hours, the patient's haemodynamic and circulatory parameters improved. On the following day, the patient became haemodynamically unstable with a MAP <50 mmHg. There was chatter in the line and even after adequate volume resuscitation, the output from the ECMO machine kept falling at the same RPM, even though the colour difference between the cannulas was maintained. Immediately, the CTVS team was contacted, and the venous cannula was pushed to 55 cm, with the reason for the poor ECHO window being given as the cannula not reaching at the junction of the inferior vena cava and the right atrium. The cardiac output transiently improved. However, after one hour, a continuous fluctuation in the ECMO output from

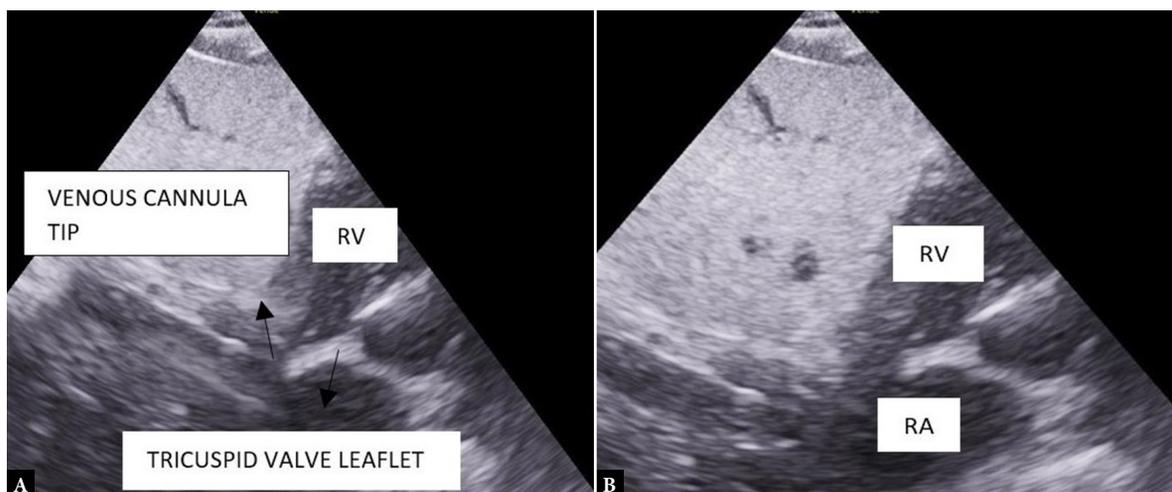


Fig. 1. Subcostal 2D echocardiography view. A. Venous cannula tip abutting the tricuspid valve leaflet. B. After venous cannula repositioning at inferior vena cava and right atrial junction. RA – right atrium, RV – right ventricle

1.5 L/min to 4 L/min was observed along with chattering. POCUS was done to find the cause of haemodynamic instability, which revealed that the venous cannula tip was abutting against the tricuspid valve (Fig. 1). The venous cannula was removed under ultrasound guidance and re-fixed at 53 cm. After this, the MAP increased to 65 mmHg, the cardiac output stopped fluctuating, and the chattering resolved. Over the next 13 days, the patient was successfully weaned from the VA-ECMO support.

This case highlights the importance of POCUS in patients with mechanical circulatory support like ECMO in order to urgently and effectively identify and solve the problem. In the present case, haemodynamic instability could have been avoided by using POCUS at the initial repositioning of the cannula or even earlier, while positioning the cannula at the ECMO initiation. Assessment of ECMO cannula position using ultrasound is the second most common indication of POCUS⁽²⁾. TEE is generally preferred for confirming the cannula position but physicians in the ICU are more familiar with POCUS and require no additional training for TEE^(3,4). There are many other potential indications of POCUS in haemodynamically unstable patients on VA-ECMO, which include assessment of volume status and fluid responsiveness, evaluation of cardiac chamber size, cardiac

output and stroke volume, detection of clot formation or cannula obstruction, and detection of air or emboli.

In summary, POCUS has a wide range of applications in patients on VA-ECMO, helping with rapid diagnosis, guiding interventions, and contributing to improved outcomes in critically ill patients requiring mechanical circulatory support.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

Author contributions

Original concept of study: SM, PB. Writing of manuscript: FQ, SK, SY, SM. Analysis and interpretation of data: FQ. Final approval of manuscript: PB. Collection, recording and/or compilation of data: FQ. Critical review of manuscript: PB.

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