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LETTER TO THE EDITOR

Venoarterial extracorporeal membrane oxygenation in septic cardiomyopathy: a case report

Oxigenación por membrana extracorpórea en miocardiopatía séptica: un reporte de caso

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Background

Refractory septic shock is defined as a condition characterized by hypotension with organ dysfunction requiring support with high doses of vasopressors (> 0.5 μg/kg/min of norepinephrine or its equivalent) and is associated with a high mortality rate > 50%[1].

One of the complications that patients with refractory septic shock may experience is septic cardiomyopathy (SCD), which has a heterogeneous prevalence due to a lack of standardization in the operational definition, ranging from 10 to 70% in patients with sepsis. SCD is defined as an acute heart failure syndrome associated with sepsis unrelated to coronary ischemia and is accompanied by one or more of the following: Left ventricular dilatation with low or normal filling pressure, decreased ventricular contractility, and/or ventricular dysfunction unresponsive to fluid infusion[2]. Patients with SCD have a 2-3-fold increased mortality compared to those with septic shock alone[3].

Venoarterial Extracorporeal Membrane Oxygenation (VA-ECMO) therapy is a form of circulatory support used as a bridge to recovery, decision-making, or transplantation. However, the indications for initiation of therapy in patients with SCD are controversial[4] because its use has been shown to increase mortality compared to venous-venous ECMO in patients with sepsis[5,6].

Case report

A 41-year-old female was admitted for a planned surgery to treat her severe endometriosis, which had not responded to medical treatment. The surgery involved laparoscopic removal of an endometriotic nodule and a discoid section of the sigmoid colon. After 2 days, she reported symptoms of systemic inflammatory response syndrome (SIRS) due to abdominal sepsis resulting from the failure of primary closure in the sigmoid colon. An emergency laparotomy was performed to address the issue.

She was then admitted to the intensive care unit and was diagnosed with abdominal refractory septic shock, requiring support with norepinephrine (1.35 μg/kg/min), vasopressin (0.06 U/h), and hydrocortisone (50 mg). A transthoracic echocardiogram showed severe biventricular failure LVEF of 19% (Fig. 1) along with troponin

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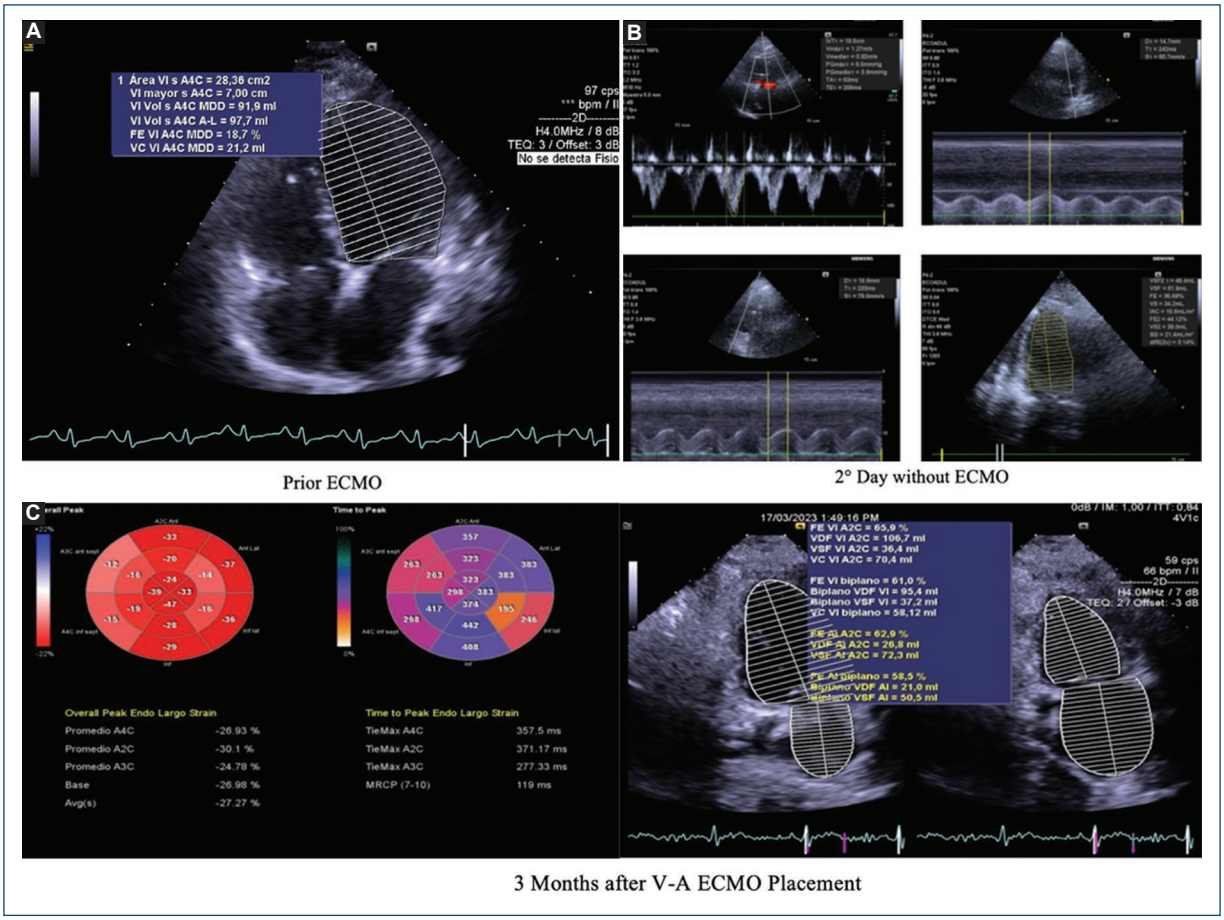

Figure 1. A transthoracic echocardiogram was performed before and after V-A ECMO. **A:** day before ECMO placement. Transthoracic echocardiogram hours before starting VA-ECMO therapy shows LVEF by Simpson's method at 22%. **B:** 2° day without ECMO. Transthoracic echocardiogram 2 days after retiring VA-ECMO shows LVEF improved at 42% by Simpson's method. **C:** 3 months after V-A ECMO placement with LVEF. V-A ECMO: venoarterial extracorporeal membrane oxygenation; LVEF: left ventricular ejection fraction.

I HS 25.0 ng/mL, troponin T 1451 ng/mL, and BNP 23456 pg/mL, leading to a diagnosis of mixed shock and treatment with dobutamine (5 μg/kg/min) and levosimendan (0.05 μg/kg/min).

As the patient's condition worsened (Fig. 2), a second echocardiogram showed evidence of cardiac failure LVEF of 18.7% (Fig. 1). The patient was diagnosed with INTERMACS 1 cardiogenic shock and SCAI E, so VA-ECMO was started with Femoro-Femoral V-A cannulation (Venous 25 FR, Arterial 19 FR) with a distal perfusion catheter and an initial flow of 3.0 L/min at 2500 RPM. The treatment lasted for 3 days and resulted in improved cardiac function and a decrease in the need for vasopressors. Follow-up echocardiograms demonstrated significant recovery of the left ventricular ejection fraction (LVEF), which improved to 42% after 3 days (Fig. 1) and reached 65% after 3 weeks. In addition, there was a reduction in biomarkers with troponin I 0.133 ng/mL and troponin T 330.5 ng/mL. During her hospitalization, the patient had necrotizing fasciitis, requiring surgical intervention. At present, she enjoys a good quality of life, with the ability to perform instrumental activities of daily living and maintain functional independence.

Discussion

Septic cardiomyopathy (SCD) is a complication of septic shock with an unclear pathophysiology. It is believed that micro- and macro-circulatory alterations affecting the myocardium, along with the production and action of pleiotropic inflammatory molecules, are involved. Some authors suggest that SCD represents a state of protective "hibernation"[3].

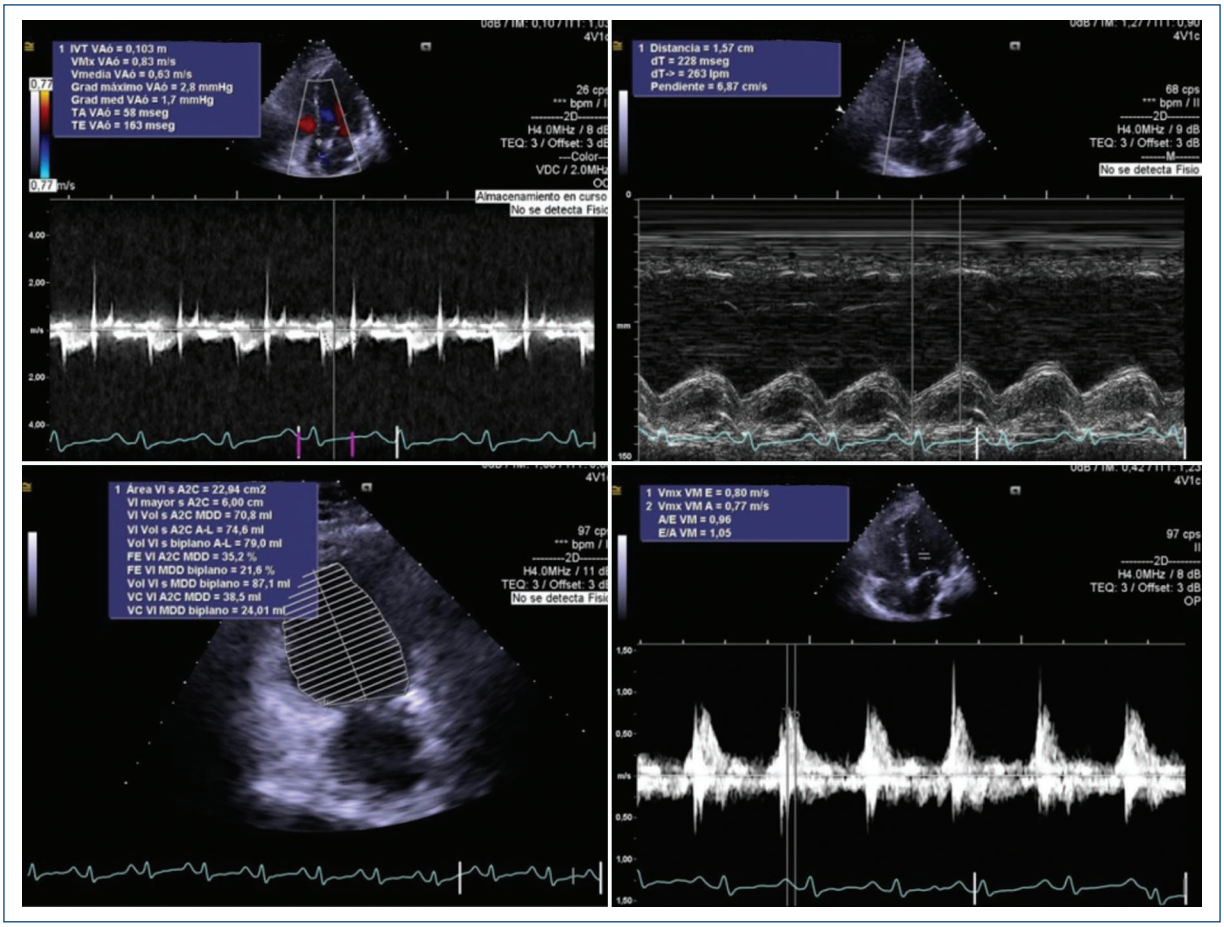

Figure 2. Transthoracic echocardiogram. Four days after surgery. Systolic dysfunction with severe myocardial damage, with non-dilated, non-hypertrophic left ventricle, generalized hypokinesia, with calculated LVEF by Simpson's method at 22%, 3D LVEF at 27% with a global longitudinal strain of –9%. These findings are consistent with stress cardiomyopathy (likely systolic dysfunction induced by sepsis). Diastolic dysfunction without an increase in filling pressures. LVEF: left ventricular ejection fraction.

Established risk factors for SCD include mechanical ventilation (odds ratio [OR]: 1.22, 95% confidence interval [95% CI]: 1.01-1.36) and the use of vasopressors such as norepinephrine (OR: 1.42, 95% CI: 1.23-1.65), vasopressin (OR: 1.39, 95% CI: 1.17-1.65), epinephrine (OR: 2.59, 95% CI: 1.81-3.70), and dopamine (OR: 1.88, 95% CI: 1.54-2.30)[7,8]. In the case at hand, the patient received 72 h of invasive mechanical ventilation and a dose of norepinephrine equivalent to 1.45 μg/kg/min, as calculated using the norepinephrine equivalence.

The use of VA-ECMO in cases of reversible cardiogenic shock, such as SCD, is controversial[5], nevertheless, there have been cases with positive outcomes[9,10]. In this case, the patient had a SAVE Score of –7 (30% probability of survival) before VA-ECMO initiation. However, a recent study showed that VA-ECMO in patients with severe myocardial dysfunction (LVEF < 20%) within the first 4 days of septic shock was associated with lower mortality compared to patients without VA-ECMO therapy[4]. At present, no standardized scale exists for assessing survival in this patient population.

After VA-ECMO therapy, the patient fully recovered cardiac function with a good prognosis for life and function. This was confirmed by the echocardiogram performed at 3 months, which showed an LVEF of 65% and global longitudinal strain –27 (Fig. 2).

Conclusion

The treatment of refractory septic shock is complex and requires a personalized approach. Further research

is needed to determine the efficacy of VA-ECMO therapy in this patient population.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from all patients, and secured approval from the Ethics Committee. SAGER guidelines have been followed as applicable to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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