Extracorporeal membrane oxygenation before surgical repair of a postinfarction ventricular septal defect

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Massive PI-VSD as visualized by echocardiography.

Central Message

Extracorporeal membrane oxygenation may be a viable rescue strategy for patients presenting in cardiogenic shock from large PI-VSDs before surgical repair.

See Editorial Commentary page e125.

▶ Video clip is available online.

Postinfarction ventricular septal defects (PI-VSDs) are associated with high rates of mortality. Percutaneous treatments are limited to smaller lesions in favorable anatomic locations with less encouraging outcomes for patients in cardiogenic shock. At present, open surgical repair remains the gold standard for the management of these patients. Ideal conditions for successful repair have been suggested at least 7 days from the time of acute myocardial infarction (AMI) to allow viable tissue to mature and reduce the risk of recurrent ventricular septal defect (VSD).¹

In practice, however, it may not be possible to safely delay repair for large defects with significant left-to-right shunting and profound cardiogenic shock. The use of venoarterial extracorporeal membrane oxygenation (VA-ECMO) may be a temporizing maneuver to permit adequate resuscitation before attempting definitive surgical repair. We present a case of successful VA-ECMO resuscitation and delayed surgical repair of a massive PI-VSD.

CASE SUMMARY

A 53-year-old, morbidly obese (132 kg) man with type 2 diabetes mellitus and urticarial vasculitis presented to a rural emergency department with an inferoposterior ST-segment elevation AMI. On arrival to a tertiary care center 3.5 hours later, his condition deteriorated to severe cardiogenic shock. He was intubated on an emergency basis and underwent coronary angiography demonstrating a large, inferobasal VSD and complete occlusion of a

dominant, culprit left circumflex artery. Transthoracic echocardiography confirmed a large VSD with a diameter of 35 to 40 mm (Video 1) and left-to-right shunting. Initial cardiopulmonary support consisted of intra-aortic balloon counterpulsation, high-dose infusions of inotropic support, and assist-control ventilation with 100% inspired oxygen

VIDEO 1. Massive PI-VSD as visualized by echocardiography before definitive surgical repair. LA, Left atrium; LV, left ventricle; MV, mitral valve; PI-VSD, postinfarction ventricular septal defect; RV, right ventricle. Video available at: [http://www.jtcvsonline.org/article/S0022-5223\(17\)32843-X/fulltext](http://www.jtcvsonline.org/article/S0022-5223(17)32843-X/fulltext).

FIGURE 1. Key metabolic parameters before and after ECMO support. ER, Emergency room; ECMO, extracorporeal membrane oxygenation.

fraction. An arterial blood gas confirmed cardiogenic shock with extremis (arterial lactate concentration 8.2 mmol/L).

Given the patient's life-threatening cardiogenic shock, it was determined by our heart team that emergency surgical repair was not appropriate and peripheral VA-ECMO was subsequently initiated to permit correction of the profound metabolic derangements and multiorgan resuscitation. In addition, vasopressors and intermittent volume resuscitation were used to maintain mean arterial pressures greater than 65 mm Hg and central venous pressures between 10 and 15 mm Hg. Within 24 hours of extracorporeal membrane oxygenation (ECMO) support, the patient's metabolic status improved and arterial lactate concentration normalized (Figure 1).

Surgical repair of the massive VSD was performed 9 days later by infarct exclusion. Postoperative transesophageal echocardiography showed improved biventricular function (on support) with no residual VSD. The ECMO circuit was converted to central at the time of the operation, and continuous support was maintained until decannulation 6 days later.

With the efforts of the interdisciplinary perioperative care team, the patient was eventually repatriated to his home hospital on postoperative day 86. An echocardiogram before discharge showed low-normal biventricular function with small residual shunt. The patient has since successfully transitioned back to the community. He is fully functional and living independently now approximately 1 year since his presenting AMI.

DISCUSSION

Although not currently a routine practice, preoperative VA-ECMO in critically ill patients on maximal medical therapy may be useful as a rescue strategy.² Hobbs and colleagues³ previously described successfully temporizing 2 patients from a series of 3 with PI-VSDs of 2.9 and 2.4 cm for 7 and 4 days, respectively, before surgical repair.

Liu and colleagues⁴ impressively reported the successful delayed repair of a 38-mm PI-VSD, facilitated by 7 days of VA-ECMO support. As such, there appears to be a growing role for preoperative ECMO in the setting of PI-VSD associated with shock, and, importantly, this strategy seems applicable even for lesions of substantial size.

After the initial challenge of completing a surgical repair, rehabilitation required the efforts of many individuals across multiple disciplines. This patient spent a total of 86 days at our facility, including 38 days in the cardiac intensive care unit, consistent with recent findings by Rosvall and colleagues⁵ showing significantly greater resource use for obese patients after cardiac surgery. Our commitment to a multidisciplinary, team-based treatment plan was critical in ensuring his successful recovery and eventual hospital discharge.

CONCLUSIONS

Our case demonstrates that prolonged VA-ECMO may be useful in resuscitating otherwise moribund patients with PI-VSD requiring surgery. Although larger series are required to determine whether results to date are generalizable to most centers, ECMO appears viable as a temporizing resuscitative strategy before declaring the futility of attempting PI-VSD repair. A team-centered mentality during what will likely be a protracted course in the hospital may be useful after such attempts are made in obese individuals.

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