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Commentary: Get up and go! Pushing the envelope in ambulatory extracorporeal membrane oxygenation

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In this issue of *JTCVS Techniques*, Hess and colleagues¹ describe the case of a 45-year-old man with nonischemic cardiomyopathy who presented with acute decompensated heart failure and cardiac arrest. The patient was successfully resuscitated, and 12 hours later he was placed on bifemoral venoarterial (VA) extracorporeal membrane oxygenation (ECMO) plus a temporary axillary Impella 5.5 (Abiomed, Danvers, Mass) microaxial left ventricular assist device as a bridge to heart transplant, which was undertaken 13 days later. Whereas both ambulatory peripheral VA-ECMO and the ECMO+Impella 5.5 arrangement have been reported,^{2,3} the ambulatory VA-ECMO+Impella 5.5 combination has not. Given that recent changes in heart transplantation allocation have increased the use of temporary mechanical circulatory support (MCS) as a bridge to



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CENTRAL MESSAGE

A patient bridged with peripheral VA-ECMO and an axillary Impella 5.5 after cardiac arrest was able to be ambulated and successfully bridged to heart transplant.

transplant,⁴ VA-ECMO+Impella 5.5 will undoubtedly become more prevalent, as will opportunities for promoting ambulation.

Two major issues related to VA-ECMO must be addressed: the role of left ventricular unloading and the benefits of ambulation. The role of left ventricular unloading, whether it should be done routinely or selectively, and the optimal technique are staples of ECMO debates.⁵ Because different clinical situations (eg, postcardiotomy shock, decompensated heart failure, and acute cardiogenic shock) warrant different strategies, the decision must be individualized to the patient.^{6,7} The novel approach taken by Hess and colleagues¹ was to initiate peripheral VA-ECMO simultaneously with placement of an Impella 5.5, which the authors expected would provide better cardiac support and be less likely to move or cause hemolysis than alternative devices (eg, femoral Impella CP). Avoiding MCS devices in both femoral arteries may also lower the risk for limb ischemia. Although simultaneous VA-ECMO+Impella 5.5 placement may not be appropriate or cost-effective for all patients (eg, patients postcardiac arrest with unknown neurologic status), this strategy is well suited for patients with acute decompensated heart failure with plans for bridging to transplant or destination MCS. In addition, having an Impella 5.5 in place allows for earlier weaning from ECMO.

Notably, multiorgan dysfunction initially made this patient ineligible for orthotopic heart transplant, but he became eligible after a period of ECMO support. This ECMO-related improvement in end-organ function has also been seen in patients successfully bridged to durable

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left ventricular assist devices⁸ and is a critical component of bridging to transplant.

It is important to appreciate how difficult it is to ambulate patients with femoral cannulation. In the largest reported series of this kind, Pasrija and colleagues³ were able to ambulate only 14% of patients (15/104) with femoral cannulation, and Hess and colleagues¹ acknowledge that fewer than one half of all patients with femoral VA-ECMO achieved ambulation. Even in the setting of venovenous ECMO for respiratory failure, a large multicenter trial of 511 patients found that 35% of patients were able to be ambulated; however, those with femoral venous cannulation were 5 times less likely to walk, compared with those with alternative (dual-lumen internal jugular or subclavian) cannulation.⁹ Thus, we must be realistic in our expectations.

Achieving mobility requires local institutional experience. Most centers have gained ambulatory ECMO experience informed by lessons learned from bridging patients with end-stage lung disease to lung transplant.^{10,11} Respiratory failure caused by the coronavirus disease 2019 pandemic also has created large-scale demand for ECMO and for ambulation opportunities with ECMO. It is critical to identify who should or should not be ambulated with bifemoral cannulation, because some—maybe most—patients are not candidates for ambulation. An experienced multidisciplinary team (surgeons, intensivists, perfusionists, nurses, physical therapists, nutritionists, others)¹² can identify criteria that must be satisfied and develop safety checklists that would allow patients on peripheral VA-ECMO to overcome the barriers to ambulation.

Above all, do no harm, recognizing that one inadvertent decannulation event could be catastrophic. That said, the inertia of stagnation is powerful, and overcoming the “we’ve never done this before” mindset can be challenging—yet dedicated teams can have a meaningful impact. And sometimes, seeing is believing; for the doubters, Hess and colleagues¹ have included an accompanying video showing the patient safely walking.

It is intuitively obvious that patients who are doing better are more likely to achieve ambulation. Now, the Can Cardiopulmonary Rehabilitation Facilitate Weaning of Extracorporeal Membrane Oxygenation (CaRe-ECMO) randomized study¹³ will test whether earlier mobilization

itself improves clinical outcomes. These eagerly anticipated results may fundamentally alter our emphasis on mobilization.

This report from Hess and colleagues¹ is informative to readers and multidisciplinary teams because it illustrates what can be achieved with teamwork and expands the boundaries of what is possible. In time, ambulation with peripheral ECMO may become the rule rather than the exception.

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