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Early Unloading in Venoarterial Extracorporeal Membrane Oxygenation Shock: When, How, Where, and Why?

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Abstract

As extracorporeal membrane oxygenation increases the left ventricular afterload, a successful treatment plan should include strategies to address this issue. One promising approach to do so is the addition of a second device for active left ventricular unloading. However, this relatively new approach is currently only based on retrospective data. This article summarizes the current perspectives on this approach, provides recommendations for its application, and highlights the need for randomized data on this topic.

Keywords: extracorporeal membrane oxygenation, percutaneous mechanical circulatory support, cardiogenic shock, heart failure

Why?

When extracorporeal membrane oxygenation (ECMO) is used to retrogradely perfuse the aorta, the left ventricle (LV) afterload increases. Although some patients can compensate quite well, others do not. Thus, myocardial recovery can be hampered, which might lead to fatal complications, such as an LV thrombus formation. Consequently, we need to think about the increase in LV afterload in ECMO patients. Thus, clinical teams that manage ECMO-supported patients must prepare protocols to address the increase in LV afterload, deciding on when an intervention is necessary or not.

How?

Patients receiving ECMO support for cardiogenic shock experience an increase in wedge pressure, a surrogate marker for LV end-diastolic pressure. Many institutions will add an Impella device (Abiomed) to decrease and normalize LV pressures in such cases. The combined Impella and ECMO support (ECMELLA) actively unloads the LV, thereby preserving or enabling myocardial recovery. Although prospective, randomized data are lacking, some observational studies on using ECMELLA are available. In a recent study, more than 500 propensity score-matched patients were compared, indicating lower mortality in the ECMELLA cohort.[1] However, ECMELLA was also associated with more complications in that study. The rationale for this association is that a second mechanical circulatory support device requires secondary vascular access, so there is a higher risk of bleeding and ischemia. Thus, more work on decreasing the risk of complications with ECMELLA is needed, which might improve the benefit-risk ratio of this approach. For example, using ultrasound for vascular access alongside meticulous follow-up care might reduce the risk of severe bleeding or ischemic events.

In addition to the Impella device, other options for LV unloading exist. A Canadian meta-analysis showed that an intra-aortic balloon pump for LV unloading in ECMO patients

might also work, and this therapy combination may contribute to counteracting the increase in LV afterload.[2] The best strategy for the patient depends on the hospital setting and the health care team's familiarity and expertise with the specific percutaneous device.

When?

While early LV unloading may improve outcomes, using ECMELLA could also be seen as a bailout strategy. In the previously mentioned propensity score-matched study, the data implied that the use of ECMELLA is better earlier than later. In this regard, a recently completed follow-up analysis reviewed ECMELLA-supported patients receiving both devices within 24 hours and indicated that those with early LV unloading had a lower mortality risk than patients with a delayed LV unloading. In fact, the later the Impella was implanted after the ECMO, the higher the risk of mortality. Thus, this supports the use of LV unloading as a primary (early) treatment strategy rather than as a bailout strategy.

Where?

The LV unloading can be done in the catheterization laboratory or the operating room. Once again, the best place depends on the individual hospital setting and team expertise. Some hospitals use different strategies to address the increase in LV afterload, eg by centrally cannulating the patient on ECMO or using left atrial venoarterial (LAVA) ECMO. Other hospitals are familiar with the Impella device and complete the procedure in a catheterization laboratory. These preferences will primarily determine the best place to perform the LV unloading. The most important takeaway is that the increase in LV afterload is recognized as a relevant problem and that there is a structured way to assess and, if needed, to address it.

Conclusion

Because ECMO support increases the LV afterload, a successful treatment plan must include strategies to address this, tailored to the local expertise and resources. An interdisciplinary approach is necessary, as multiple experts need to work together to yield favorable results. ECMELLA support should be used earlier rather than later; however, this recommendation is based on retrospective data. Therefore, inherent bias does exist. Future prospective, randomized trials are planned.

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