Is the venoarterial extracorporeal membrane oxygenation circuit your frenemy?

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When facing a dramatic crisis in the operating room, most surgeons would do well to abide by Norm Shumway's second law: "The pump is your friend."¹ The hemodynamic stability achieved with extracorporeal support has been exploited by three generations of surgeons and continues to provide a fail-safe strategy when things go awry. Despite its numerous advantages, however, cardiopulmonary bypass (CPB) comes at a steep price—the need for full anticoagulation. Venoarterial extracorporeal membrane oxygenation (VA ECMO) has gained favor as a short-term bridging strategy for patients requiring cardiopulmonary support in the days after surgery. As with CPB, however, the need for anticoagulation generally results in a reluctance to add coagulopathy to the list of ongoing challenges that typically accompany this type of patient. In their article in this issue of the *Journal*, "Short-term Venoarterial Extracorporeal Membrane Oxygenation for Massive Endobronchial Hemorrhage After Pulmonary Endarterectomy," Guth and colleagues² describe an ingenious method for leveraging all the advantages of VA ECMO support before the consequences of anticoagulation and pulmonary stasis become relevant.

Pulmonary endarterectomy can cure chronic thromboembolic pulmonary hypertension, but, as a technically demanding procedure that is infrequently performed in most centers, it carries several unique risks—particularly the potential for massive endobronchial hemorrhage. For patients with this complication, survival depends on the immediate execution of a proven rescue strategy. These maneuvers, nicely described by the San Diego group³ and others,^{4,5} should be mentally rehearsed by the surgeon before the start of each endarterectomy. Although only a few patients in the series of Guth and colleagues² had this complication develop (as expected in such a highly experienced group), this ultra-short term use of VA ECMO yielded results that justify its inclusion in the commonly accepted emergency protocols. The critical importance of anticipating and identifying massive

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Central Message

Short-term venoarterial extracorporeal membrane oxygenation support should be strongly considered in the treatment algorithm for massive endobronchial hemorrhage during pulmonary endarterectomy.

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endobronchial hemorrhage and then managing it with VA ECMO is illustrated in the modified Jamieson flow diagram (Figure 1)³ and is consistent with the requirements outlined in the study of Guth and colleagues.²

Beyond their practical relevance in the setting of complicated pulmonary endarterectomies, Guth and colleagues'

FIGURE 1. This flow diagram represents a modification of the traditional approach² to endobronchial hemorrhage during pulmonary endarterectomy. CPB, Cardiopulmonary bypass; VA ECMO, venoarterial extracorporeal membrane oxygenation; PA, pulmonary artery; OR, operating room.

findings² could be a catalyst for generating hypotheses about managing related intraoperative crises. The combination of coagulopathy and marginal right-ventricular function occurring after prolonged CPB is all too familiar to transplant surgeons and those implanting mechanical circulatory support devices. Likewise, many aortic surgeons will appreciate the occasional need for enhanced hemodynamic support after a complex circulatory arrest procedure when trying to restore hemostasis with “packing, protamine, products, and patience.” Whether a brief period of extracorporeal support with a heparin-coated circuit offers a friendly alternative during these and related encounters, however, is a question that, in the words of W. W. Mayo, must be “left open for further thought and research.”⁶

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