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Commentary: Combination effects of mechanical circulatory support: A cardinal consideration in venoarterial extracorporeal membrane oxygenation support!

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Over the past few years, the adult cardiac extracorporeal membrane oxygenation (ECMO) support has risen rapidly.¹ Venoarterial (VA) ECMO support can rescue patients with acute cardiogenic shock, including postoperative cardiac failure.² Cannulation for VA-ECMO is not difficult for cardiac surgeons; however, the consideration is not the same as traditional cardiopulmonary bypass with full heparinization and cardiac arrest.

In this issue of the *Journal*, Fukunaga and colleagues³ describe a case with descending aortic thrombosis and acute type B dissection during central ECMO. In this case, the EPOA aortic cannula was inserted to descending aorta, and the aortic dissection and thrombus were disclosed by transesophageal echocardiography.

Although the definite cause of aortic dissection is not clear, the combination of intra-aortic balloon pump (IABP) and aortic cannula in the descending aorta carries the high risk of aortic injury. When the balloon inflates, the cannula is pushed against the aortic wall. If the high-pressure blood flow from VA ECMO cannula was directed to the aortic wall, the combination of direct injury and blood flow injury might be the cause of aortic dissection.

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CENTRAL MESSAGE

Aortic blood flow is an interplay of ECMO cannula position, ECMO, and native left ventricular function during VA ECMO support.

The thrombus formation in the proximal descending aorta is also likely related to the position of aortic cannula (Figure 1). The North/South syndrome, or blue-head

FIGURE 1. In the case with aortic cannula and IABP in descending aorta, the mechanical trauma and blood flow stagnation resulted in complications. LV, Left ventricular; IABP, intra-aortic balloon pump.

syndrome, is characterized as upper-body cyanosis (cerebral hypoxia) while patients are on femoral VA-ECMO.² The blood flow pattern in the aorta is a combination effect of native left ventricular output and the blood flow from arterial cannula in VA ECMO. The unloading procedure (pulmonary vein venting) could avoid pulmonary edema but could also decrease native left ventricular outflow. The blood flow stagnation could happen at the “perfusion border,” especially if the pulsation is low. Thrombus formation will occur because the patient is not full heparinized. Thus, VA ECMO is easy to implant, but the cannula position, the management of native left ventricular output (preload, afterload, inotropic agents), the presence of IABP, and left ventricular decompression procedures all require careful consideration of their individual and combined effects. Once the patient is placed on mechanical support, careful monitoring and thoughtful

consideration of the blood flow pattern are the key to avoiding complications.

In summary, this is a case demonstrating the serious effect of inappropriate aortic cannula during ECMO + IABP support. The combined effect of mechanical circulatory devices and left ventricular performance is a cardinal consideration in managing patients with cardiogenic shock.

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