The Preemptive Use of ECMO to Facilitate High Risk Percutaneous Cardiac Interventions: Left Main PCI and Percutaneous Balloon Aortic Valvuloplasty

Chiem D, Patel K, Mahajan A
David Geffen School of Medicine at UCLa, Los Angeles, CA, USA

Introduction: High-risk percutaneous cardiac interventions will likely become common as technology continues to evolve. As these procedures carry significant risk, the use of circulatory support should be considered. We present a case of ECMO-facilitated high-risk percutaneous cardiac interventions being performed on a cardiac cripple with severe aortic stenosis and left main disease.

Case Presentation: A 69-year old male, with aortic stenosis (AS), ischemic cardiomyopathy, coronary artery disease, pulmonary hypertension, and morbid obesity presented with a myocardial infarction and cardiogenic shock. Cardiac catheterization revealed severe stenosis of every namable branch and artery, including 70% stenosis of the left main coronary artery (LMCA). Transesophageal echocardiography (TEE) revealed severe AS, aortic valve area (AVA) 0.85cm², LV dysfunction with EF 15-20%, septal/anterior akinesis, and lateral/inferolateral hypokinesis. Due to high surgical risk and lack of targets for bypass grafting, the patient was scheduled for left main percutaneous coronary intervention (LM PCI) and balloon aortic valvuloplasty (BAV) supported by extracorporeal membrane oxygenation (ECMO).

After placement of central venous, pulmonary artery, and radial artery catheters, anesthesia was induced with etomidate, lidocaine, and succinylcholine. After initiation of left femoral ECMO, mixed venous oxygen saturation (SvO₂) increased from 53% to 83%. LM PCI was carried out. During inflation of the LMCA angioplasty balloon, LV function became markedly impaired, but due to ECMO support, the patient’s SvO₂ and MAP remained stable. BAV was performed, increasing the AVA to 1.46cm². The patient underwent ECMO decannulation the next day. Follow-up TEE showed stable AVA and improvement in LV function with mobilization of the akinetic segments. His postoperative course was uneventful, and he was discharged on postoperative day #20.

Discussion: As percutaneous cardiac interventions continue to evolve, especially in the field of transcatheter aortic valve implantation (TAVI), high-risk procedures performed on patients deemed too ill for surgery will become common. What were once considered lower risk procedures than open interventions may no longer be so due to complex co-morbidities. BAV and TAVI both require balloon inflation in and occlusion of the aortic root, which stops coronary perfusion and systemic cardiac output, and raises LV afterload, leading to myocardial ischemia and possible circulatory collapse. LM PCI also carries risk, as it requires angioplasty balloon inflation in the LMCA, which stops all left-sided coronary blood flow. As with our patient, angioplasty balloon inflation was associated with depression in pulsatility and LV function. ECMO has been traditionally described as a rescue technique in the setting of cardiac arrest. Here we describe its use to electively provide circulatory support for percutaneous cardiac procedures that would otherwise lead to circulatory collapse in a patient with little hemodynamic reserve. This case highlights the importance of the preemptive use of circulatory support to facilitate high-risk percutaneous cardiac interventions in patients who would not be able to tolerate the hemodynamic challenges associated with them.