Introduction: Coordination of biventricular assist device (BiVAD) pump speed and flow is challenging, particularly in the setting of acute changes in volume, ventricular function, and hemodynamics. These must be considered in managing emergencies in BiVAD patients. We present a case of severe pulmonary edema following exchange of centrifugal VAD pumps in a patient requiring BiVAD support.

Case Presentation: A 21 yo student presented with one month of dizziness, malaise, mild tachycardia and hypotension. He deteriorated rapidly over the course of several hours, and was diagnosed with presumed viral myocarditis. TTE showed acute biventricular systolic failure (EF<20%). Tandem Heart BiVADs were placed via central cannulation and the patient was transferred to our institution for initiation of heart transplant workup. On arrival, a significant A-A gradient was present; TEE revealed large pericardial and left pleural effusions. The patient was taken to the OR for exploration and replacement of Tandem Heart devices with Centrimag VADs. After uneventful off-pump RVAD exchange, RVAD speed was reduced as LVAD tubing was clamped for exchange. Mean PAP increased from 25 to 38mmHg. The patient developed frank pulmonary edema, accompanied by severe acute hypoxemia (PaO2 21mmHg on 100% FiO2). After LVAD exchange and clamp removal, suctioning and PEEP application, oxygen requirements gradually decreased. Upon arrival in the ICU, saturations were 85-95% on 60% FiO2. Over the next several days FiO2 and PEEP were weaned and the patient was extubated. Ventricular function improved: the RVAD was explanted on day #8, LVAD on day #13 and the patient was discharged home on day #18.

Discussion: Acute interruption of centrifugal pump VAD flow is a rare and potentially catastrophic event. This case provides a dramatic illustration of right and left circulatory interdependence and the consequences of acute interruption. In the setting of ongoing RVAD pump flow, the temporal relationship between LVAD flow interruption and severe pulmonary edema suggests a causative effect. Other possible contributing etiologies to increased pulmonary vascular permeability include viral syndrome, sepsis, or transfusion related lung injury.

Case reports describe off-pump RVAD or LVAD explantation in patients that have recovered ventricular function1,2. Strategies for exchange involving VAD flow interruption in the setting of biventricular support all have significant risk. Initiating cardiopulmonary bypass allows simultaneous interruption of BiVAD flow, but requires cannulation and anticoagulation. Alternatively, off-pump simultaneous BiVAD flow interruption avoids vascular overload, but requires brief circulatory arrest and cooling with associated complications. When some native left ventricular function exists, serial pump flow reduction may be an option: outcomes may be improved by applying moderate PEEP during pump manipulation to reduce the rise in the pulmonary transvascular pressure gradient. This case report demonstrates how consideration of ventricular interdependence in the setting of emergency surgery in BiVAD patients can help direct management.

References: