Impella Device as a Reliable Strategy to Unload the Left Ventricle During Peripheral Venoarterial Extracorporeal Membrane Oxygenation Support: The Massachusetts General Hospital Experience

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Background:

Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) allows for the hemodynamic stabilization of patients in cardiogenic shock. Peripheral cannulation via the femoral artery and vein has become increasingly common and safe, leading to an uptrend in the number of patients cannulated for VA-ECMO. While VA ECMO allows for improved oxygenation and circulation, increased afterload coupled with the aortic valve failing to open may cause the left ventricle to be insufficiently unloaded, leading to LV distension, stasis, pulmonary edema, and myocardial ischemia which worsens outcomes. The "achilles heel" with respect to VA ECMO has been the ability to decompress the distended LV, which allows for decreased myocardial oxygen consumption and therefore recovery. Very small case series have detailed the use of the Impella device (Abiomed, Danvers MA) as a unique LV vent strategy in patients supported on VA ECMO. We present our institutions more robust experience utilizing the Impella as an LV vent in patients on VA ECMO.

Methods:

All patients who were cannulated for VA ECMO and underwent placement of an Impella (2.5, CP, 5.0) as an LV vent were identified using a single institutional database from 2015-present. Manual chart review was performed to identify key demographic, survival, clinical, echocardiographic, and operative details.

Results:

58 patients were placed on VA ECMO between January 1, 2015 to present. Of these, 12 had placement of an Impella as an LV vent. Indications for VA ECMO with the use of an Impella were most commonly due to STEMI (n=6), cardiogenic shock secondary to myocarditis (n=4), mechanical structural complication (n=1), and iatrogenic catheterization complication (n=1). The Impella 2.5 was most common (n= 7), followed by Impella CP (n = 4), and Impella 5.0 (n=1). The in-hospital survival rate for patients with VA ECMO and Impella was 58% (n = 7). The survivors were less likely to have presented with STEMI and to have undergone PCI. Additionally, survivors were less likely to have experienced hemolysis as a complication as

measured by LDH. Survivors were bridged to recovery (n=5), orthotopic heart transplantation (n=1), and durable LVAD as a bridge to transplantation (n=1). From an echocardiographical standpoint the survivors were more likely to have better pre-Impella LV systolic function; furthermore, following ECMO and Impella removal LV function and size had returned close to baseline parameters.

Conclusions:

The use of the Impella as an LV vent strategy in patients with VA ECMO allows for effective LV unloading and greater than 50% in hospital survival. Our results indicate a greater survival advantage in patients who present in cardiogenic shock secondary to myocarditis or mechanical complications as compared to STEMI. All patients who received an Impella had noticeable LV cavity dilation, while those who survived displayed a reduction in cavity size and an improvement in systolic function demonstrated on echocardiogram after the removal of ECMO and Impella devices.