Cardiovascular Disease and the Use of Left Ventricular Assist Device

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LVAD

Cardiovascular disease and heart attacks (see **Figure 1**) are prevalent in today's world and the leading causes of death globally.[1] Recently, left ventricular assist devices (LVAD) have been used as a bridge-to-therapy care for patients on the waiting list for heart transplants.[1] LVADs can be lifesaving, but they generally come with a long list of stipulations including changes to lifestyles, needs for caregiver support, and changes due to complications.[1] The function of LVAD is simple because of its ability to act as a pump. As seen in **Figure 2**, it is placed beneath the heart with one end attached to the left ventricle and the other attached to the aorta.[2] LVADs are increasingly used for patients who have heart failure but have gone through several treatment options that didn't work.[3] Although there are many complications incorporated with left ventricular assist devices, there are also positives to having a LVAD placed beneath the heart. Among these positives include MOA for glycemic control in patients with type II diabetes.[2]

Like several health-related topics, there are ways of detecting such complications. This is where radiology as a whole is such an important factor in the health field.[4] Imaging modalities are important in both the diagnosis and discovery of the indications found with cardiovascular disease and heart failure. Such imaging modalities used to detect heart failure, blood flow, renal function, and right and left ventricular failure include x-ray, computed tomography (CT), magnetic resonance imaging (MRI), and electrocardiograms (ECG).[4]

Echocardiography (ECG) has become the primary method for pre-LVAD placement and for post-monitoring of patients with its ability to determine ventricular size and function, as well as valve function.[5] It is ideal because of its non-invasive, widely available, and portability in post-LVAD placement.[5] This portability characteristic allows the machine to be transported to further accommodate the patients. Echo is useful for visualizing the flow of blood and helpful in the discovery of discontinuation of blood flow (see **Figure 3**).[5]

Figure 1: *Visual representation of a heart attack.*[6]

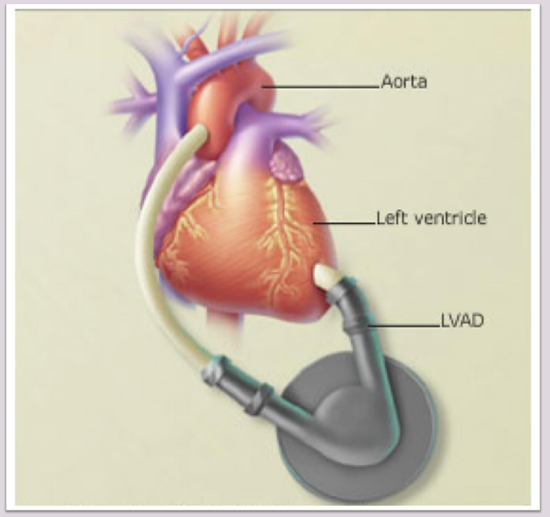

Figure 2: *Placement of LVAD in relation to the heart.*[2]

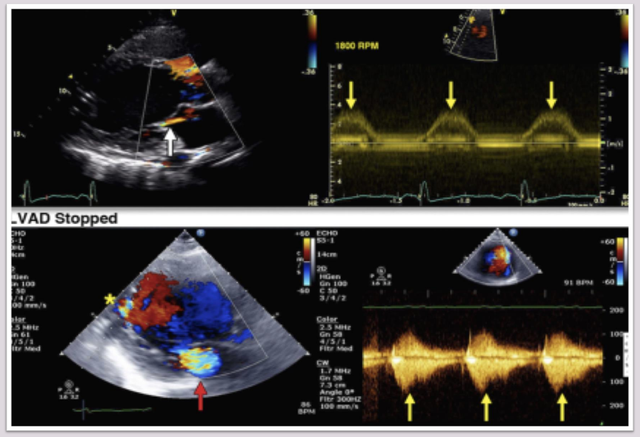

Figure 3: *Echo findings with LVAD.*[5]

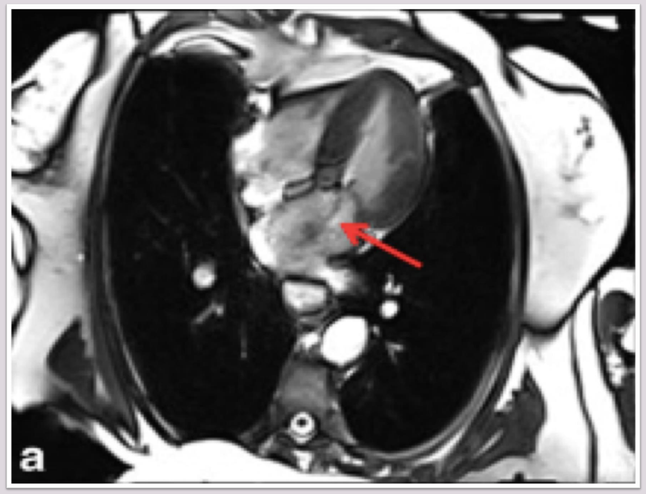

Figure 5: *MRI showing mitral regurgitation.*[8]

Figure 4: *LVAD placement visualized by CT Scan.*[7]

Computed Tomography

Computed tomography scans (see **Figure 4**) are useful in diagnosing LVAD complications, including hematomas and hemorrhage.[7] CT is useful in the detection of device malfunction and can detect outflow graft kinking and inflow cannula misalignment by the use of cardiac CT's.[7] Computed tomography allows for LVAD cannulas to be interrogated from multiple views allowing for complete visualization.[5] CT is often performed as a problem-solving tool for determining anatomy depending on the type of LVAD-related complication that is suspected. Diagnosis of complications requires familiarity with the normal appearance of LVADs on CT.[7]

Magnetic Resonance Imaging

Cardiac magnetic resonance imaging (CMR) allows patients to be evaluated prior to placement of LVAD. This extensive test evaluates cardiac anatomy, function, and tissue characterization.[8] Although MRIs will not be able to be used post-placement of LVAD, it is known for its prior detection of aortic and pulmonic flow through the heart. It allows for increased accuracy in detecting and assessing any dysfunction within the valves.[8] It is extremely useful in detecting malfunction or issues like regurgitation in mitral or pulmonic valves (see **Figure 5**).[8]

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