



### H139 The Challenges Faced in Evaluating a Death Related to Left Ventricular Assist Device (LVAD)

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After attending this presentation, coroners and forensic pathologists will understand the appropriate process involved in the evaluation of a decedent with an implanted LVAD and thus avoid some of the pitfalls experienced by others.

This presentation will impact the forensic science community by raising the awareness about an option that has been recently made available for the treatment of Congestive Heart Failure (CHF): the implantable LVAD, of which there are now a variety of devices in developmental stages in clinical trials and in routine use.<sup>1</sup> The limitations of the process involved in the evaluation performed at the Regional Medical Examiner's Office in Newark, NJ, for a decedent with a LVAD are described. The criteria for the use of LVADs, a brief review of the types and functioning of these devices, and their therapeutic complications will also be outlined.

A 57-year-old man was transported from his residence to the nearest health care center after being found unresponsive by his spouse. His downtime was estimated at 20 minutes. His past medical history was significant for end-stage CHF, status post-LVAD implantation, atrial fibrillation, status post-pacemaker implantation, gout, hypothyroidism, and obesity (Body Mass Index (BMI)=30.7kg/m<sup>2</sup>). He was later transported to the local area major medical center, where his LVAD had been previously implanted. He was diagnosed with anoxic encephalopathy and pronounced dead after failure of resuscitation.

At autopsy, he had a 942 gram heart with concentric biventricular myocardial hypertrophy. Gross examination of the heart revealed prominent subendocardial fibrosis in the left ventricular outflow tract and partial fusion of the aortic valve cusps, a finding that has been reported in the literature.<sup>1</sup> Evaluation of the heart and the device at autopsy revealed no loss of integrity of the anastomosis and no bleeding or evidence of infection. Additional autopsy findings included pleural and peritoneal effusions, passive venous congestion of the liver, and marked pulmonary congestion with numerous heart failure cells. The toxicology screen was negative. Besides the complete autopsy, the LVAD and pacemaker were evaluated by the respective manufacturers.

CHF affects approximately five million patients in the United States and about a half-million new patients are diagnosed with the condition every year. While there are pharmaceutical options for the treatment of CHF, the survival rates and quality of life with these therapies remains suboptimal. An alternative remedy is cardiac transplantation; however, as is well known to the forensic pathology community, the major limitation for this option is the availability of donors for the procedure. The research into the development of an artificial heart was initiated at the National Institute of Health in 1964. In 1994, the Food and Drug Administration approved the use of LVADs, initially as a bridge to transplantation. The device is currently used as a destination device for those too ill for cardiac transplantation.

Immediate complications of LVAD use include postoperative bleeding, with the necessity of massive transfusions with all its associated risks, and infection involving the operative site resulting in sepsis. A slightly more ominous complication is acute gastrointestinal bleeding due to the formation of arteriovenous malformations in the stomach and intestines. Other reported complications include pulmonary insufficiency with right heart failure and transient cerebrovascular ischemic episodes or strokes. The manufacturers are attempting several innovations to reduce these complications.

Several challenges were experienced while evaluating the cause and manner of death in the decedent described above. While there are several articles on the topic of LVAD in the clinical literature, a review of the forensic literature revealed only one article on this topic.<sup>1</sup>

#### Reference:

1. Padera RF & Mitchell RA: The intervened heart: Cardiac hardware in the Forensic Suite; *Academic Forensic Pathology*; 2011; 1; 166 – 176.

#### LVAD, Congestive Heart Failure, Sudden Death