Management of the Patient with an Implanted Left Ventricular Assist Device (LVAD)

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INTRODUCTION

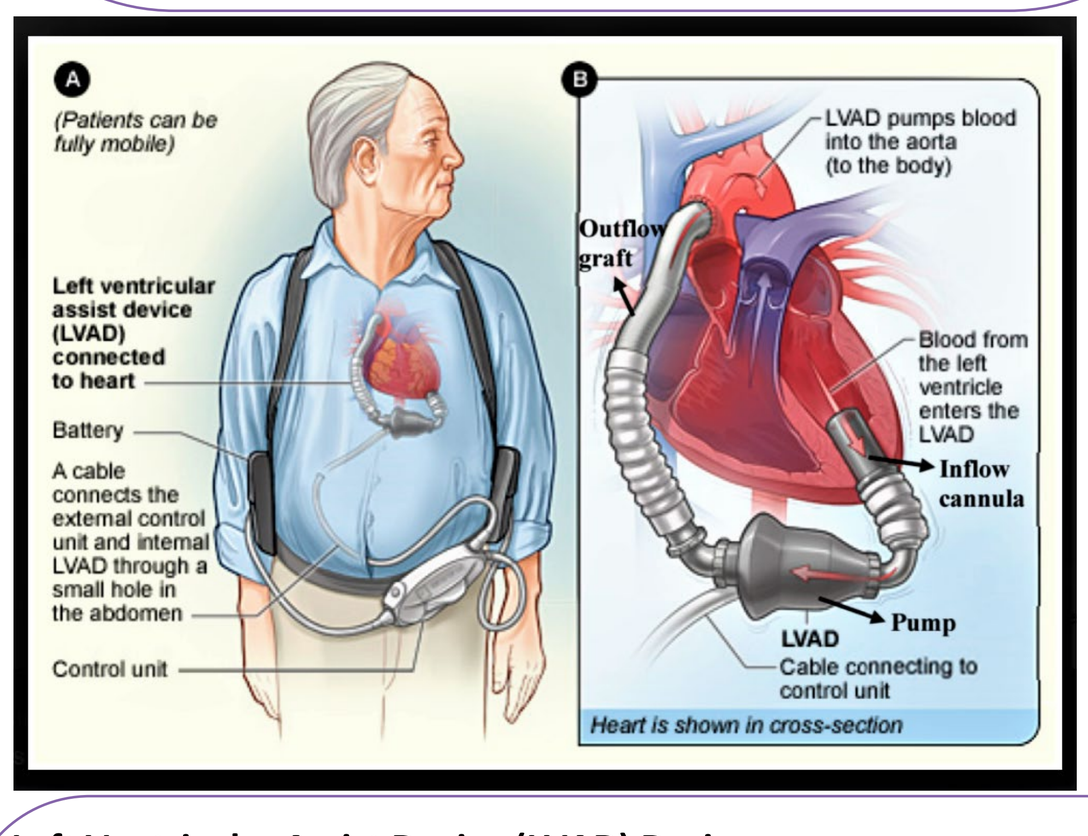
Nearly **6 million Americans** suffer from heart failure (HF). The American Heart Association (AHA) predicts that the number of individuals diagnosed with HF will increase by 46% by 2030. [1]

The AHA defines HF as a chronic condition where the heart muscle pump-function fails to meet the body's needs for oxygenated blood[1]**.** Patients with HF may experience shortness of breath, fatigue and difficulty ambulating resulting in a decrease of the quality of life. Most HF patients require pharmacological intervention to increase the cardiac contractile force; however, when the **EF drops below 25%**, their quality of life necessitates further more aggressive management.

An estimated 150,000–200,000 HF patients have advanced HF refractory to medical therapy. For this group of patients who are refractory to pharmacological therapy, orthotopic heart transplantation (OHT) or an implanted ventricular assist device (VAD) becomes the only long-term survival option.[3]

VAD is traditionally seen as a **bridge-to-transplant** for patients awaiting an OHT; this is limited primarily by donor availability to roughly 3000 cases a year. With the advancement of medical technology and the increased durability of the device, VAD therapy can also be considered a **"destination therapy"**.[7]

As a result, VAD therapy has been increasingly utilized and nearly ***2754 continuous-flow VADs (CF-VADs) are implanted annually for a total of about 250,000 patients nationally.***[10] As these devices improve quality of life allowing HF patients to proceed with activities of daily living independently, dental professionals are progressively encountering more of them. We are treating these patients in greater numbers within the NYU College of Dentistry and their care can be challenging.



LVAD Video Training

LVAD "Hum"

NYU Langone Patient Story

Left Ventricular Assist Device (LVAD) Design

The LVAD assists the *left* ventricle with its ability to generate cardiac output. The surgically implanted LVAD, placed in the lower left chest, augments blood flow via a pump, hence assisting left ventricular cardiac output. The LVAD's cannula placed in the apex of the heart drains the blood from the left ventricle into the system's pump. Blood is then pumped back into the aorta. A percutaneous cable aka "driveline" exits the abdominal wall, connecting the implanted pump to the external controller. The controller is the *brain* of the device and contains the settings, alarms and diagnostic information about the pump.

VADs use continuous flow technology, creating a **non-pulsatile continuous blood flow**. This means most patients with a VAD **will not have a palpable pulse**, and unfortunately, taking a blood pressure with a manual cuff and stethoscope will rarely allow you to define a blood pressure. It will sound like a constant 'hum'."[9]

OBJECTIVES

We have noticed a paucity of literature within our field and an absence of guidelines for the care of LVAD patients. This poster presentation aims to enlighten the dental practitioner concerning the unique considerations involved in the oral health management of these patients. As the LVAD device technology and the management of the LVAD patient improves, the likelihood of the dental practitioner coming into contact with this patient population increases. Creation of guidelines for optimal coordination of care among specialists is our goal as these patients have special needs during routine oral health care.

DISCUSSION & MANAGEMENT

Assessment of an LVAD patient is similar to any other patient. Nevertheless, some essential considerations must be kept in mind. This continuous flow device precludes most of these patients from having a **palpable pulse.** Obtaining routine vital signs requires an alternate approach.

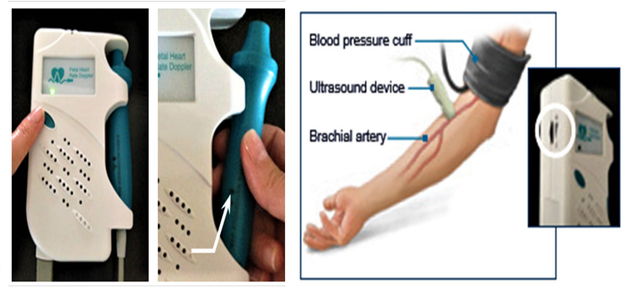
Blood Pressure, Pulse Rate, and Pulse Oximetry Assessment

Use of an automatic non-invasive blood or a Doppler unit is the best way to obtain a blood pressure on a VAD patient. In addition, pulse oximetry readings may not be accurate due to weak or absent pulses

Mean Arterial Pressure or MAP

The MAP during one cardiac cycle is considered a better indicator of perfusion to vital organs. A MAP of between **70 and 90 mmHg** is considered optimal for VAD patients. Less than 70 or above 90 mmHg results in inadequate cerebral and end organ perfusion[4]. A Doppler unit is the best way to obtain a blood pressure on a VAD patient and is illustrated below.

- Place the blood pressure cuff on upper arm
- Inflate the cuff until the absence of a pulse on the Doppler
- Deflate cuff slowly watching the gauge on the BP cuff
- Listen for the return of the pulse (swishing sound) with the Doppler
- When you hear the pulse return (swish sound), the MAP is obtained[9]



Doppler Unit Video Training

Anticoagulation and Device Failure

Anticoagulation and antiplatelet therapy (warfarin and aspirin) helps prevent thromboembolic events within the VAD (a major cause of pump system failure) and a decrease in stroke risk. A therapeutic INR must be maintained.[3] Many LVAD patients can perform an INR at home.

Endocarditis Prophylaxis

The risk of driveline, pump pocket, and hardware infections must be considered while treatment planning. Adherence to the AHA guidelines for antibiotic prophylaxis is mandatory.

Patient positioning

Clinicians should be extremely careful not to cut, twist or bend the driveline coming from the patient's abdomen. In addition, conservation of battery life should be considered for the sake of patient ambulation. The LVAD control unit can utilize a standard AC outlet while the patient is in the office; however, they will likely remain on batteries. One must ensure that the batteries are fully charged and that the patient has an extra set of fully charged ones prior to starting the procedure.

Fluid Status and Nutrition

Patients with LVADs depend on adequate intravascular volume and pressure to maintain their MAP and end-organ perfusion.[8] Nutritional support in the VAD patient is also important for peri-operative stability and post-operative healing as it minimizes immunocompromised.[6]

Care Setting

Most routine dental procedures can be safely undertaken in the outpatient setting. Consideration should be given to relegate more invasive procedures towards a more controlled and monitored ambulatory hospital setting.[2] Care should always include close communication with the LVAD patient's coordinator for ongoing support.

CONCLUSION

The incidence of HF requiring OHT is increasing within the US while the overall number of available organs remains static. Approximately 2,754 VADs are placed temporarily or as destination therapy each year, allowing these patients a relatively normal lifestyle which includes seeking dental care.

Comprehensive oral care for this patient population requires a **multidisciplinary approach**. Meeting their oral health care requirements must be addressed despite the presence of challenging comorbidities. The clinician should also keep in the mind additional entities such as Diabetes Mellitus, ESRD, HIV, etc.. Ultimately, clearly defined dental management guidelines should be developed to meet the increasing need of individuals with a history of LVAD placement.

REFERENCES

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