PROTOCOL: LEFT VENTRICULAR ASSIST DEVICE

Inclusion Criteria
- Patient with Left Ventricular Assist Device (LVAD)

EIMS Data
Procedure Components: 2-D, Color Flow Doppler, Doppler, M-Mode
Serial Study: General + any other applicable studies
First Finding: Echocardiogram performed per left ventricular assist device protocol.
Second Finding: Status post Left Ventricular Assist Device (LVAD); date of implant; type of device
Additional findings: See 'post operative history', 'ventricular assist devices' folder, add applicable
Billing Diagnosis: Heart assist device (for native heart), CHF systolic
Procedure: 2D Echo Doppler Color

Obtain the following:

2D / M-mode	CFI	Doppler	Measurement
Left Parasternal (High LPS)			
LV EF (visual) & RWMA RV size / fx Inflow cannula Outflow cannula AV opening (2D **AND** M-mode) Asc. aorta	Inflow cannula Outflow cannula AR MR TR Asc. aorta Atrial septum	~~RVOT tvi~~ TR velocity **PW** - inflow cannula **CW** - outflow cannula	LVID d/s ~~RVOT diameter~~
Apical			
Septal position (ventricular and atrial- if shifted to left - 10 beat clip) LV EF & RWMA (visual) RV size / fx (visual) Inflow cannula r/o peric. effusion / coagulum	AR MR TR Inflow cannula	**PW -** inflow cannula Mitral inflow TR velocity LVOT tvi	
Subcostal			
LV size / fx RV size / fx IVC	Atrial septum	HV	
Right Parasternal (SSN and RSC if outflow cannula not visualized elsewhere)			
Asc. Aorta Outflow cannula	Asc. Aorta Outflow cannula	**CW** - outflow cannula	

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Omit the following:

- LA strain/volumes, LV volumes, pulmonary veins, LVOT TVI (unless aortic valve opening), AV TVI, all TDI, abdominal aorta

Tips

If pump speed is to be changed during the echo, an echo consultant AND a provider from the VAD team (NP, PA, MD) must be present

No data is better than wrong (phantom) data

- ➢ Note:
  - a. most recent chest x-ray, chest CT, and echo images (especially cannula flow and window, caval window, apical images) and report (for aberrant velocities)
  - b. anatomic placement details (e.g. where does the outflow cannula insert)
  - c. device type and pump speed in the report (ask the patient)
- ➢ Outflow cannula:
  - a. Systolic velocities should be higher than diastolic velocities
  - b. Flow should be away from the transducer (below the baseline)
  - c. Try RPS, high RPS, high LPS windows (assess SSN and RSC if not seen elsewhere)
  - d. CW Doppler is preferred for the outflow cannula primarily to acquire the highest gradient and to more easily note the presence of obstruction (kinks in the cannula, etc.). Report the CW Doppler velocity in EIMS.
- ➢ Inflow cannula:
  - a. Systolic velocities should be higher than diastolic velocities
  - b. PW Doppler is preferred for the inflow cannula primarily to avoid the mitral inflow which is a common contaminant.
  - c. Avoid signals where the mitral inflow contaminates the inflow cannula flow.
- ➢ The HeartMate 3 artificial pulse algorithm causes periodic rapid changes in pump speed and is responsible for temporarily higher cannula flow peak velocities.
- ➢ Color:
  - a. Adjust color scale to help place pulsed wave sample volume
  - b. Decrease color gain to minimize color artifact

Caveats

- If color flow Doppler demonstrates worsening regurgitation by ≥ two grades, perform a comprehensive regurgitation assessment
- Obtain RVOT diameter and TVI only if calculation of total cardiac output is desired. The total cardiac output (combined LVAD flow output and native LVOT flow output [if any]) is equal to the RVOT cardiac output.

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