Heartware: Unique Pediatric Applications

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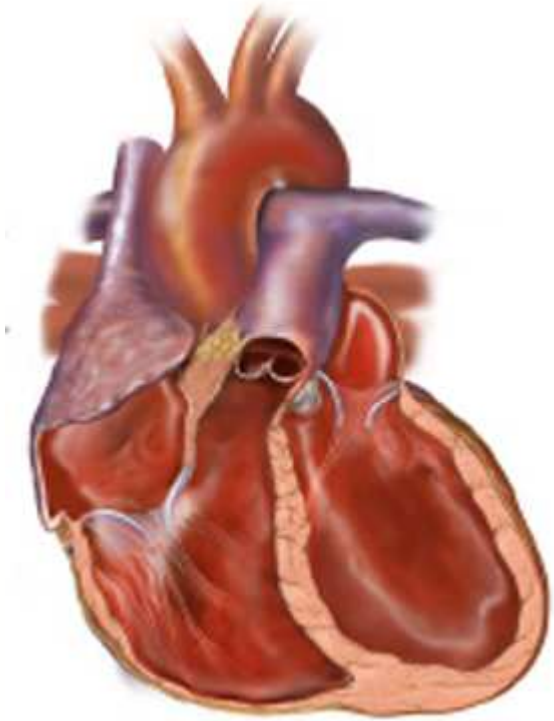
Children's Hospital of Philadelphia℠
Cardiac Center

Cardiology 2018

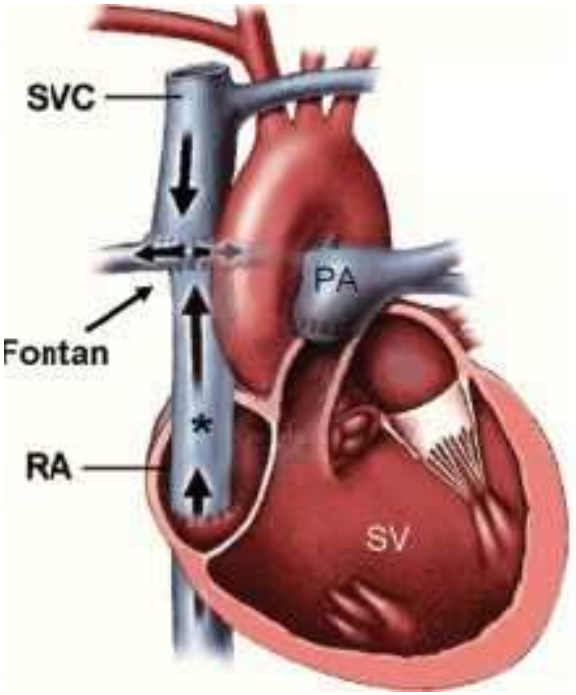
Unique Heartware Applications

Two Patient Groups

Biventricular Failure



Failing Fontans

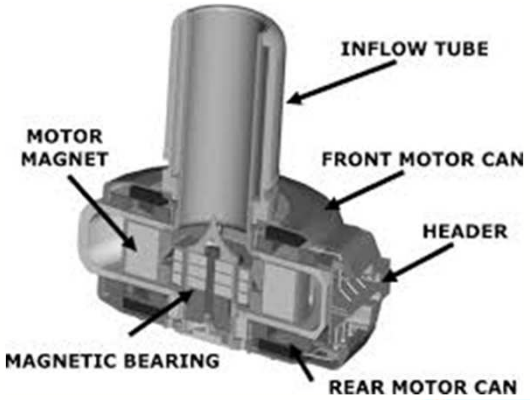


Unique Heartware Applications

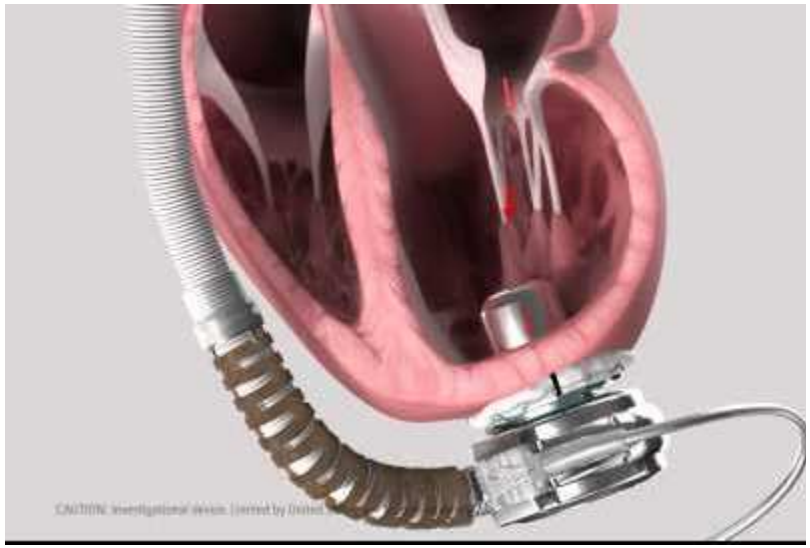
- Surgical Implant Techniques
- Postoperative Management
- Considerations

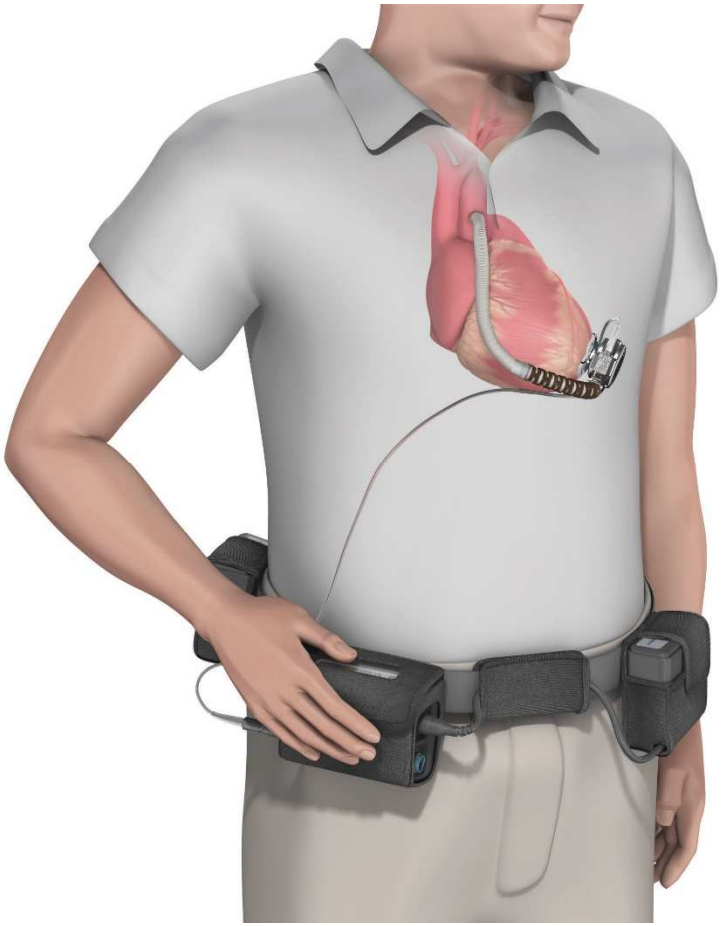
Heartware HVAD

- Continuous Flow Device
- Levitating Impeller Driven
- Passive Magnets
- 140g
- Flows up to 10LPM



Up Close






2740 RPM
4.5 Watts
5.0 L/min
HeartWare

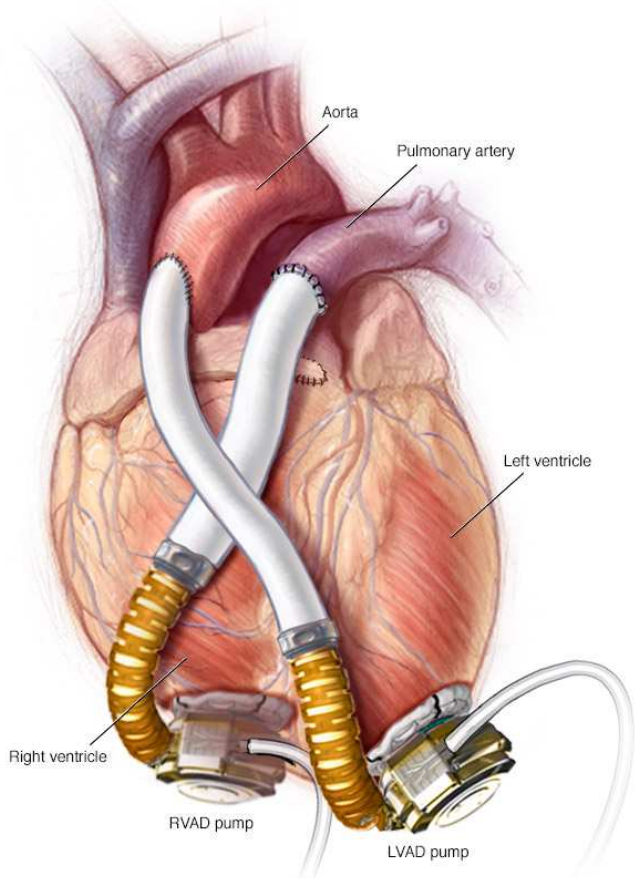
VAD Management at CHOP

Shared role between Perfusion and Nurse Practitioners

- Perfusion is responsible for all VAD disposables and equipment
- Perfusion manages in-hospital patients
- Nurse Practitioners manage patient and family education
- Nurse Practitioners manage patients once they go home and in outpatient clinic

Biventricular Failure

- Requiring the implant of two Heartware HVADs



Case Report:

RV

16 y/o F 59kg 166cm 1.4 m^2 BSA

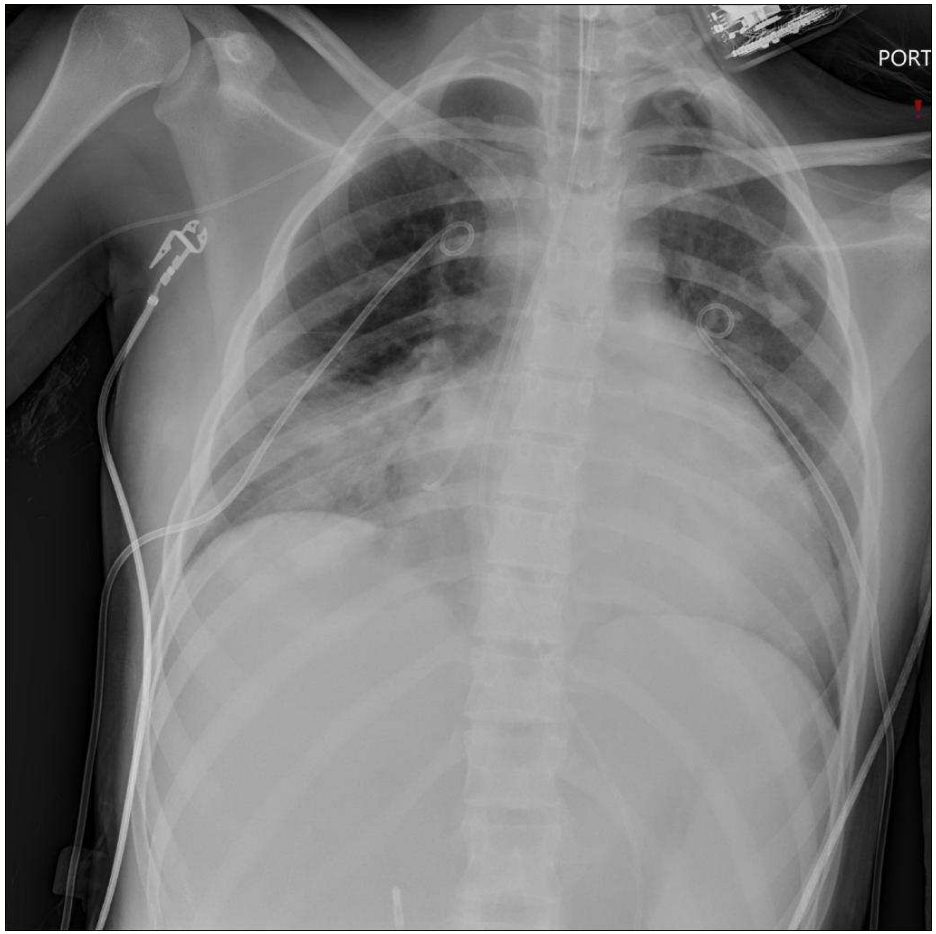
4^{th} Pediatric HW BIVAD

ICU Admission

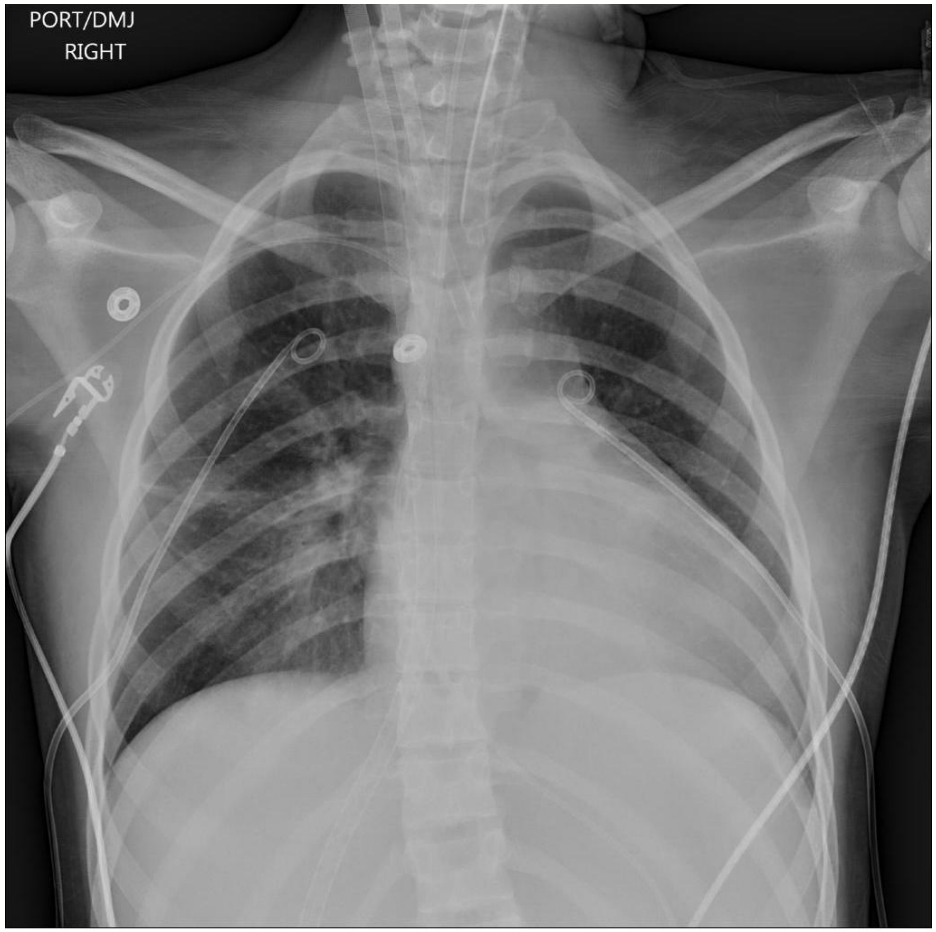
- Malaise/Viral Symptoms
- IVIG
- Biventricular Failure
- Biopsy Proven Acute Myocarditis

- **Placed on ECMO 9 days after admission**

Before ECMO



On ECMO



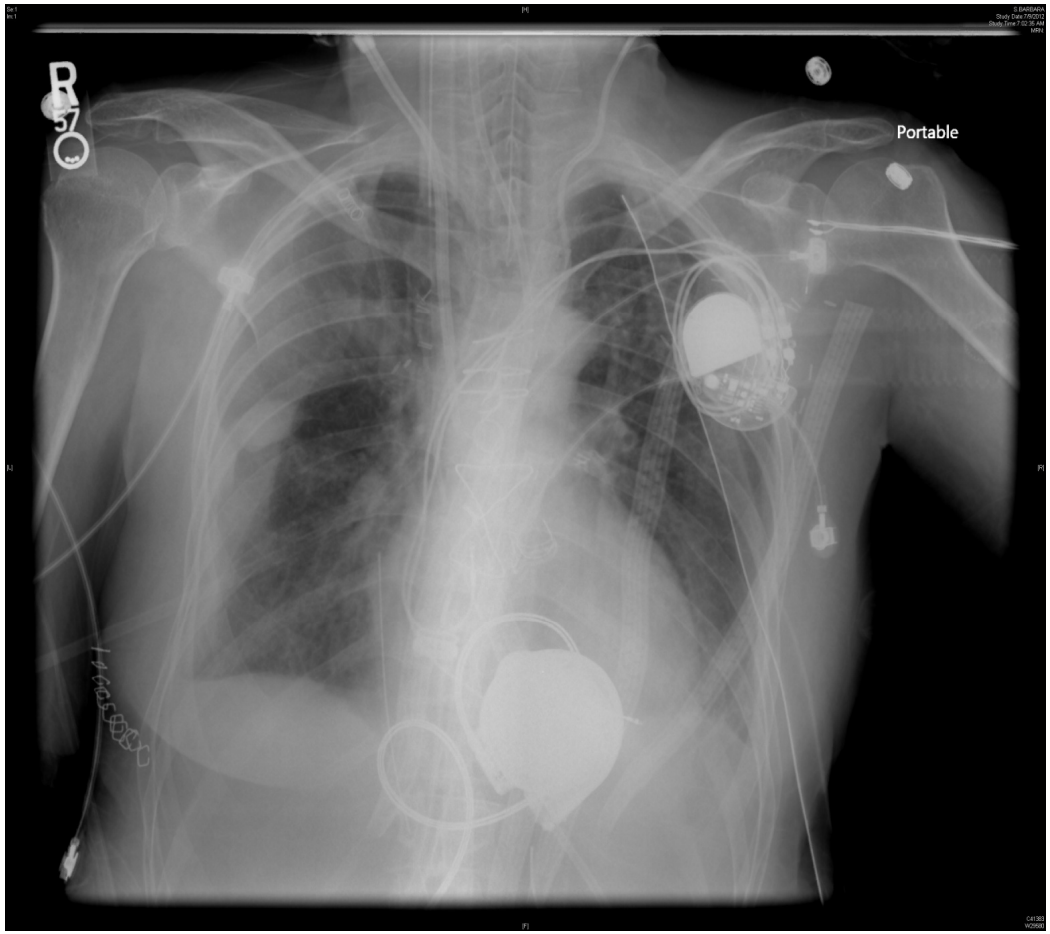
On ECMO

LVAD Insertion

- CPB: 106min XC: 11min
- Stay Warm
- Deliver CPG to Close PFO
- Implant HW LVAD in Standard Fashion

- Wean from CPB to LVAD Support
  - Milrinone and Nitric
- Poor RV Function, Poor LVAD Filling

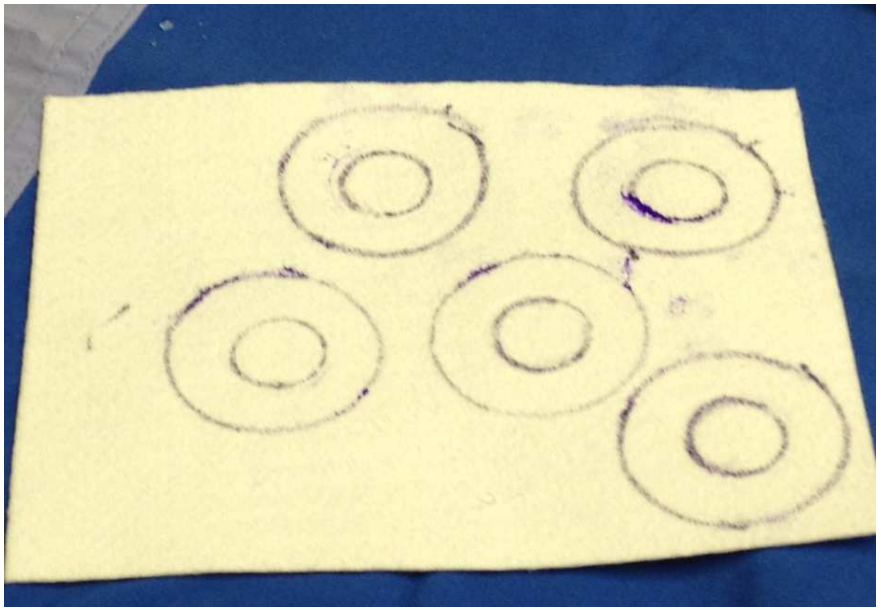
LVAD

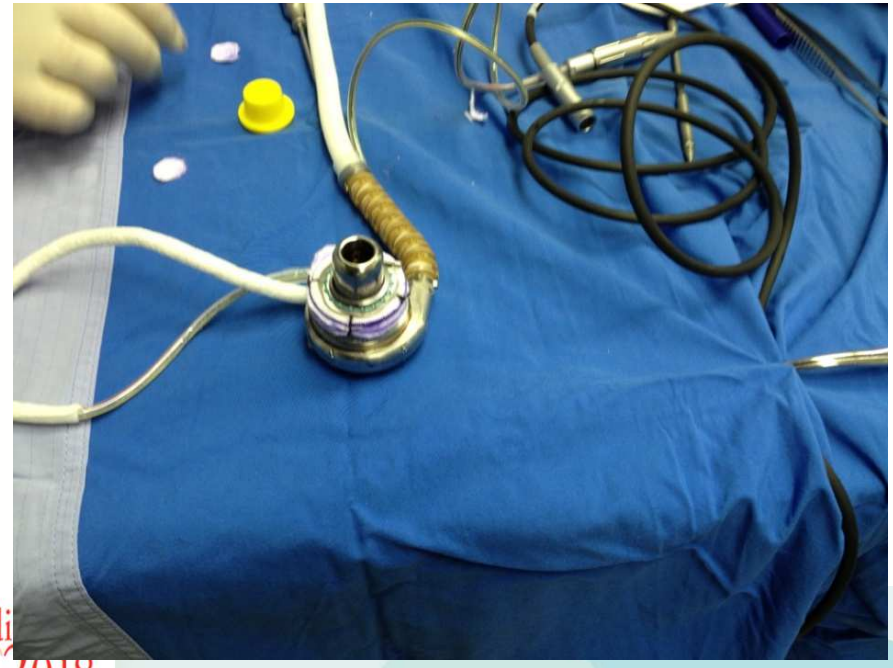


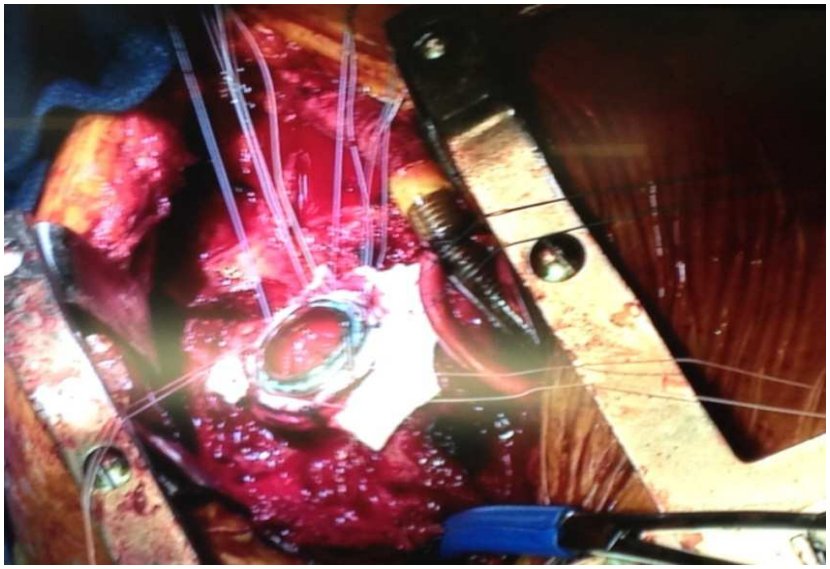
RVAD Insertion

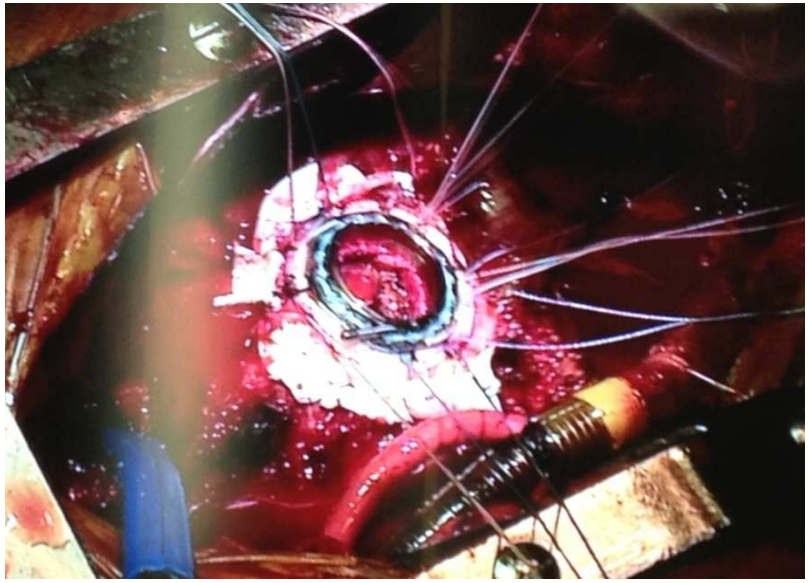
- Re-initiate Bypass
- CPB:87min XC:14min
- Prepare Second Device

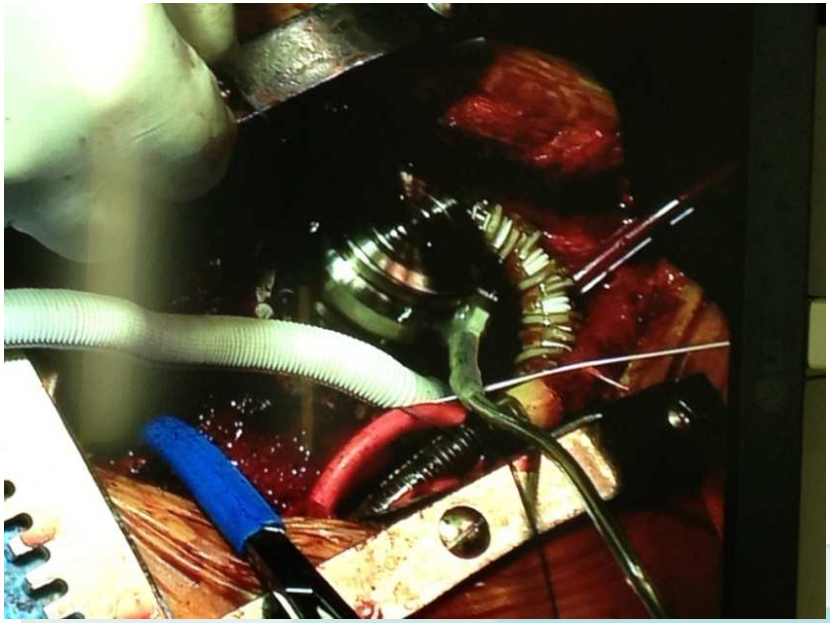
- RVAD Insertion
  - Required Felt Donut Spacers x 5
  - Required VAD Attachment to Diaphragm

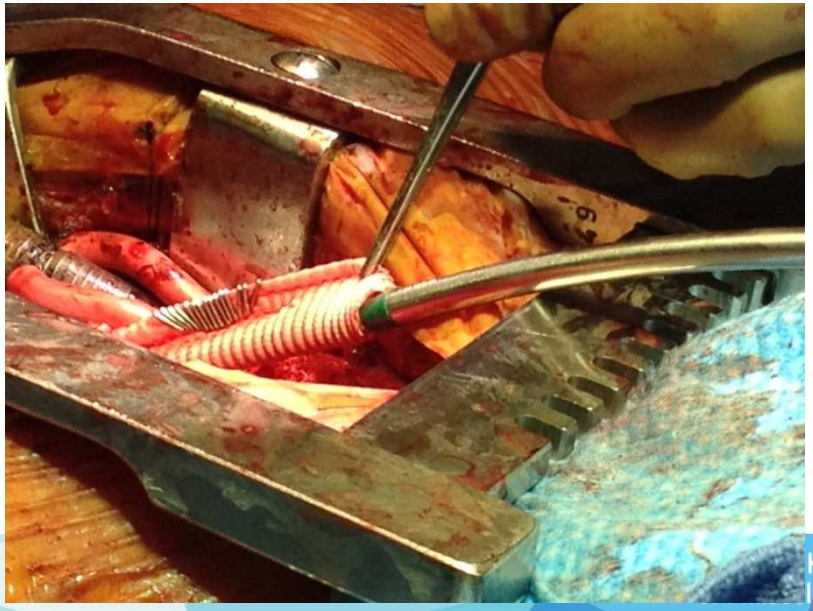




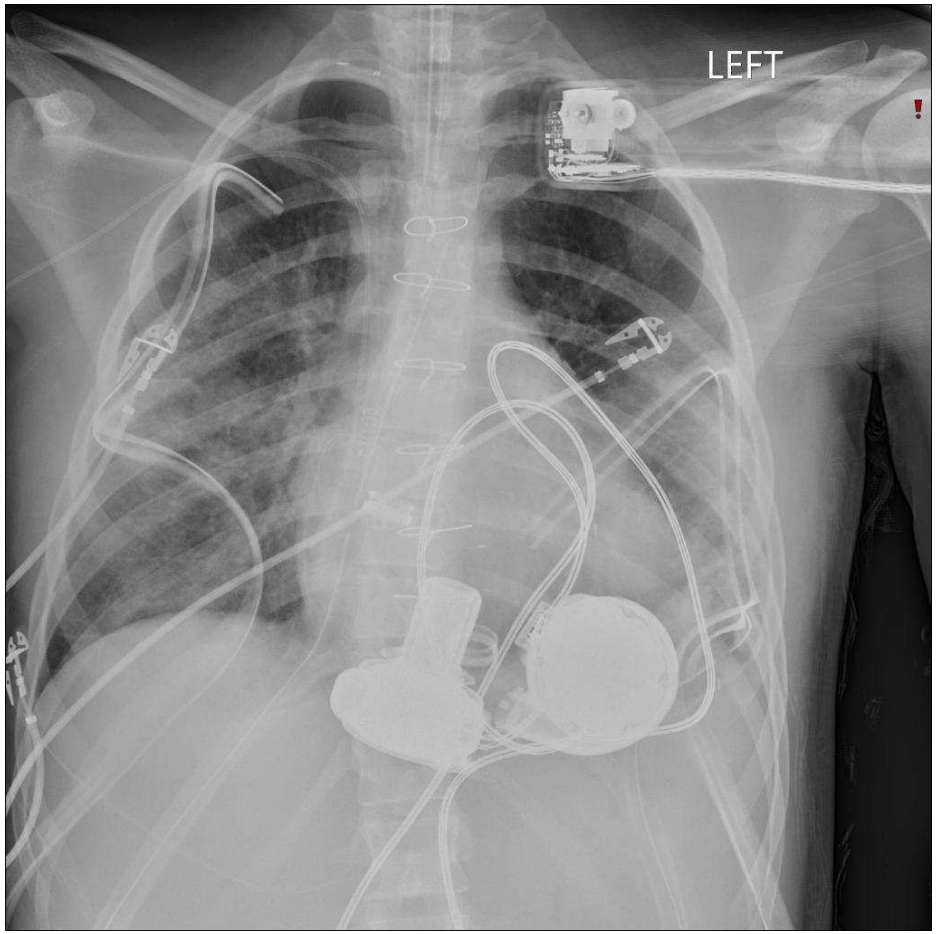








BIVADS

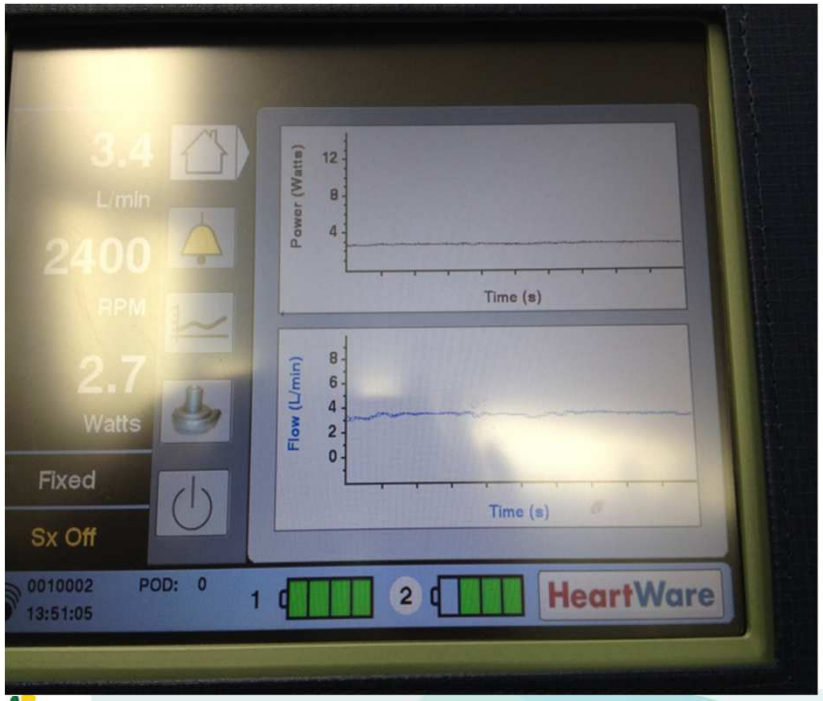


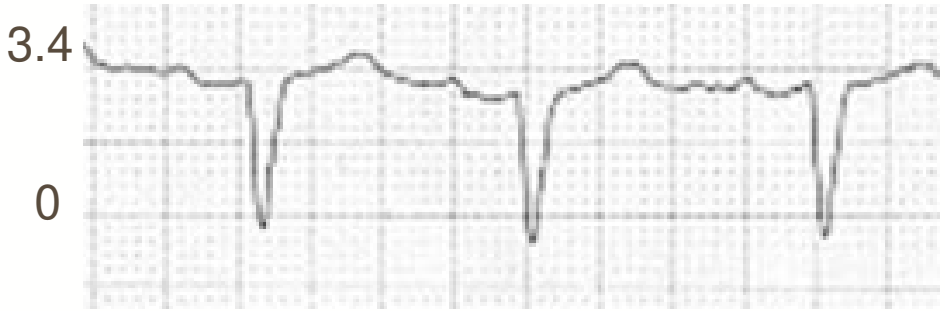
HW SETTINGS

- RPMs:
  - LVAD: 2600
  - RVAD: 2400
- Flows
  - 3.5-6 LPM
- Power
  - 2.5 – 3.5W

Post-Operative Management

- Unique WAVEFORMS
  - Lacked the normal peak and trough
  - Flattened waveform on both RVAD and LVAD due to continuous flow in preload and afterload
  - Suction Events





Post-Operative Challenges

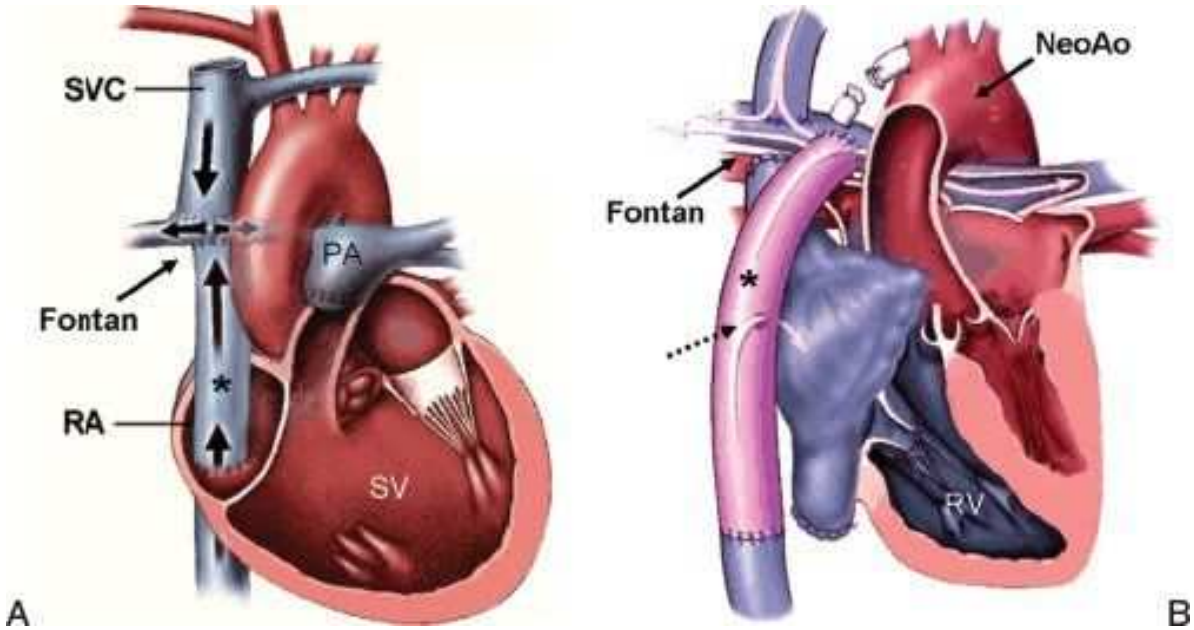
- Anticoagulation
  - Often Subclinical INR: 1.45
- E. A. T. Management
  - Esmolol, then Metoprolol
- Suction Events
  - Fluid Management, PVC's, EAT.

Recovery

- Out of bed: POD-10
- CICU:POD-24
- CHOP: POD-34
- Transplanted 73days after insertion

Failing Fontan Population

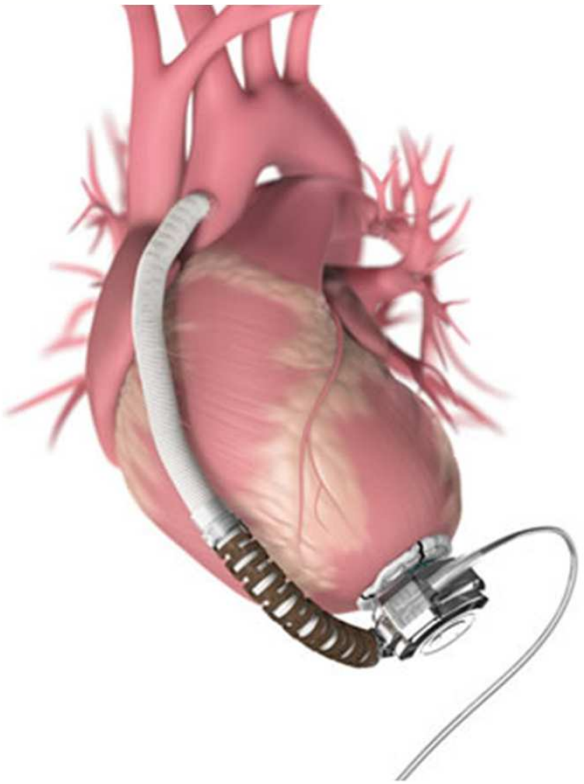
- Currently Two Approaches to implanting HVAD
  - Ventricular Insertion
  - Atrial Insertion



Ventricular Implantation of HVAD

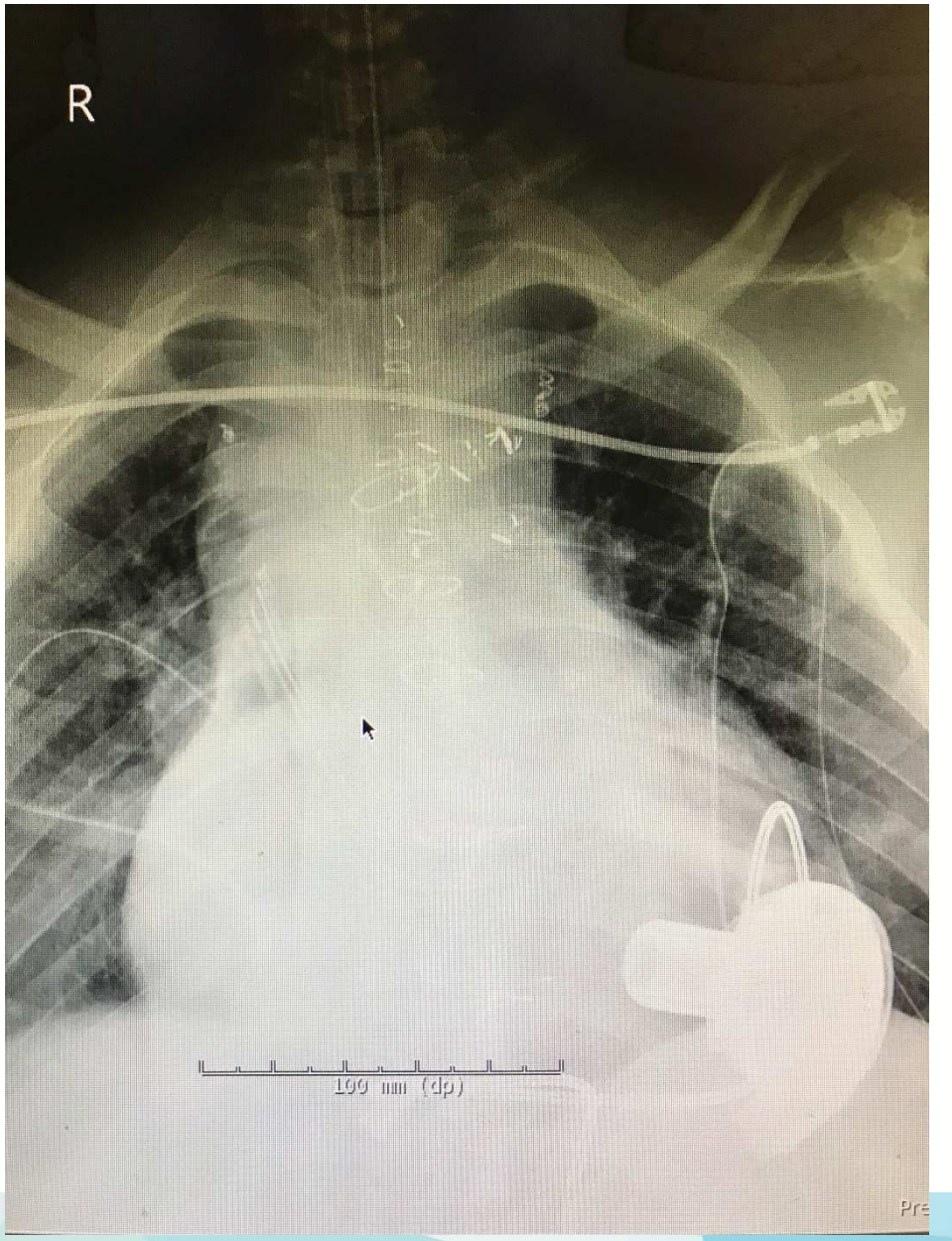
- Previously the most common implantation location with devices.

- Not always possible in smaller patients



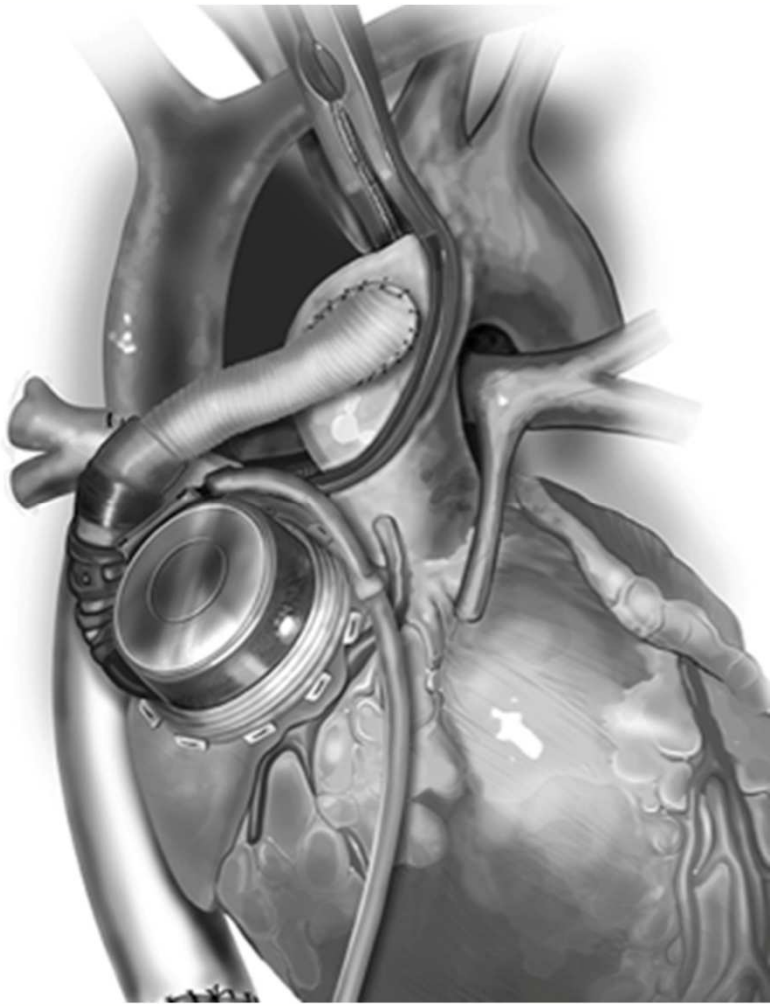
Ventricular Implantation

- Implanted 3 patients with this method
- Some have been with the AV valve removed
  - Improve flow to the device
  - Prevent valve from suctioning into device inflow


R
100 mm (dp)

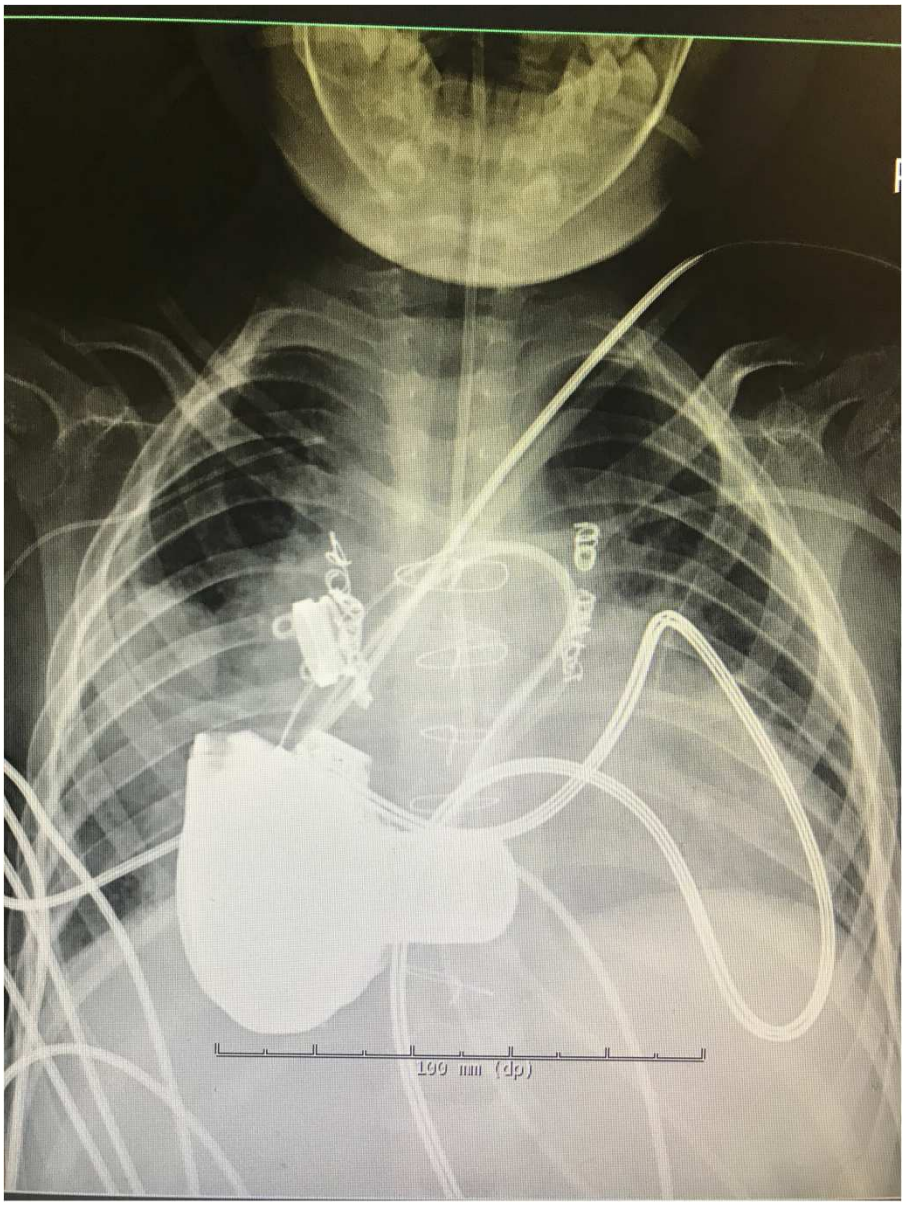
Atrial Implantation of HVAD

- Implanted into the common atrium
- Choice for smaller patients



Atrial Implantation

- Great success
- 6 patients
- Have implanted patients as low as 0.6m² BSA
- Have implanted with felt donut spacers
- Some have been with removed AV Valve
  - Prevent valve from suctioning into device inflow


100 mm (dp)

Ventricular vs Atrial

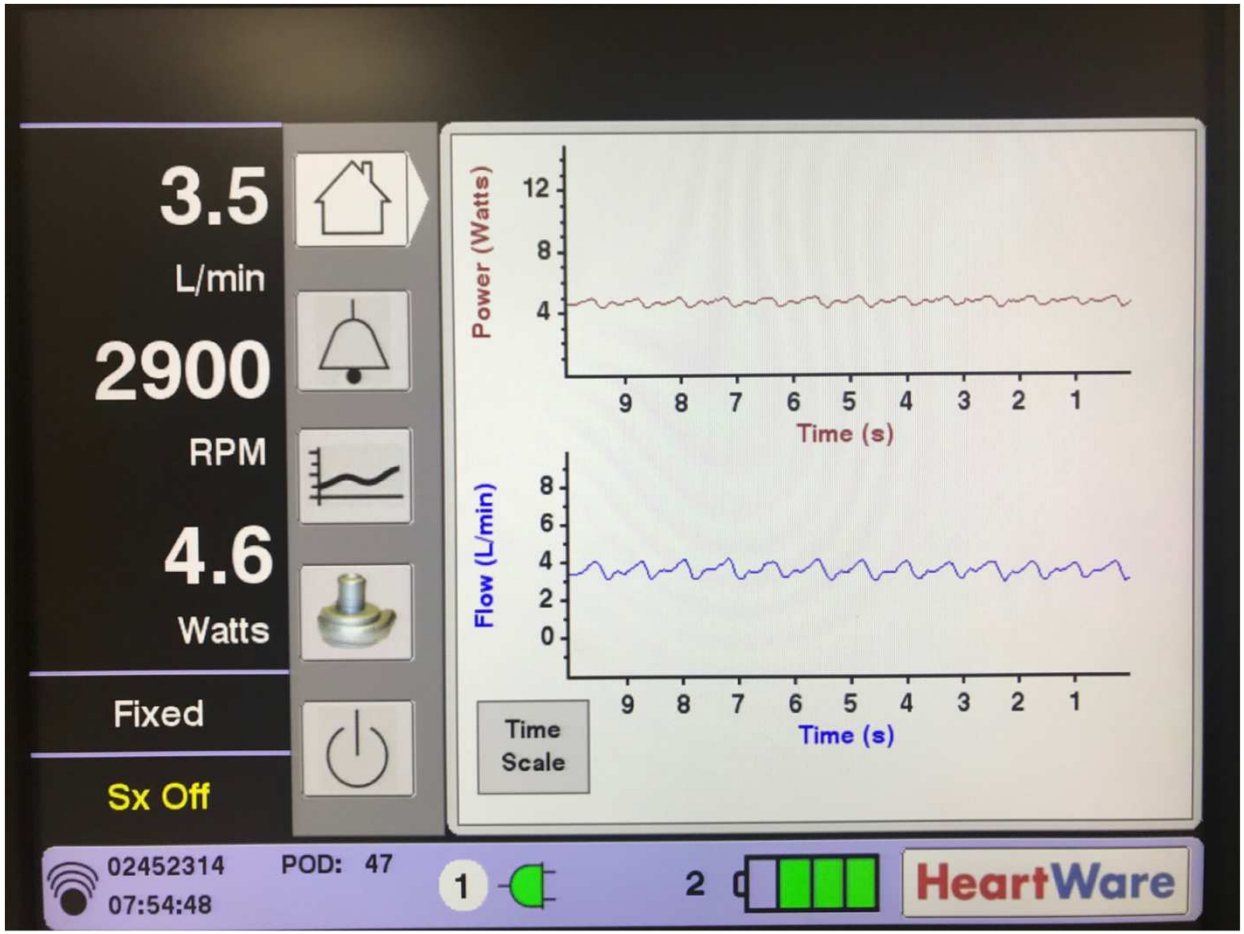
- Our experiences have led us to consider implanting atrially in virtually all failing Fontans.

- Many ventricular implants have had issues with flow to the HVAD.

Post-Operative Management

- Use of Fontan pressure to ensure decompression of single ventricle
- Fluid Management
- Waveform Recognition
  - Dampened waveform compared to normal
  - Usually more pulsatility will indicate the need to unload ventricle more

Waveform on Fontan Patient



Summary

- Education of team members of unique applications
- Recognition of waveforms
- Volume management
- Frequent ultrasounds to ensure decompression and position in both patient groups

Summary

- BIVAD
  - Not many institutions utilize due to high risk of complications.
  - Many opt to use a temporary RVAD (i.e. Tandem or Centrimag).
  - Very particular in patient selection
  - No lack of equipment
    - 2 Monitors
    - 4 Controllers (2 Primary 2 Backup)
    - 2 Battery Chargers
    - 12 Batteries

Summary

- Failing Fontan
  - Atrial implant with excision of AV valve is becoming choice.
  - Atrial cannulation in patient as old as 16 years old and young as 3 years old.

Thank You

CAUTION: Investigational device. Exclusively for clinical investigation.

Investigational device to be used by Qualified Investigators Only.