HeartWare use in the Pediatric Population

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I have no financial relationship with any of the devices or materials discussed within this presentation.

VAD Indications

• Low Cardiac Output
• Ventricular Dysfunction
• Cardiac Arrest
• Failure to Wean from CPB
• Bridge to Transplant
• Destination Therapy

Pediatric Ventricular Assist
History of Pediatric VADs

Thoratec PVAD
- Extracorporeal
- Pneumatic
- Pulsatile
- 65mL SV
- 1.3-7.2 LPM
- Ambulatory

Berlin Heart
- Extracorporeal
- Pneumatic
- Pulsatile
- 10-80mL SV
- Ambulatory

Paradigm Shift
- Pulsatile VADs
- Potential for thrombus
- Pneumatic VADs
- Large equipment
- Limited mobility
- Extracorporeal VADs
- Contraindication for discharge

Pediatric Population Considerations
- Kids want to be active
- Discharge to home!
  - School
  - Social
- Preparation for transplant
  - Sensitization
  - Long wait times
VAD Usage at CHOP

HeartWare HVAD

- Passive Magnets
- Levitating Impeller
- Continuous Flow
- 160g
- Flows up to 10LPM
- BSA 1.5m² 0.5m²

Unique Pediatric Concerns

- Size of the heart
- Size of the chest cavity
- Complex anatomy
- Lifestyle/support post-implant
CHOP Experience

- 23 Patients
  - 8 Patients with a BSA <1.0m²
  - 7 Single Ventricle
  - 2 HeartWare BiVAD
- 15 Successfully transplanted
- 2 Currently awaiting transplant
- 1 Destination therapy

HeartWare in Small Patients

- 8 Patients with a BSA <1.0m²
- 2 smallest successful HVAD implants in the world
  - 13kg, 0.58m², 4yo (128 days, transplant)
  - 13.7kg, 0.59m², 3yo (559 days, transplant)
  - Failing Fontans

HVAD Concerns in Small Patients

- Will it fit?
- What if we need RVAD?
- Can we generate **LOW** enough flow?
  - Minimum RPM 1800
  - Expected Flow: 1 – 5.3LPM
  - Narrowing outflow graft
  - Low flow alarm 1LPM

HVAD Strategies for Small Patients

- Optimal positioning of the inflow cannula
  - Felt spacers (5-7)
  - Help prevent inflow obstruction with sternal closure
HVAD Strategies for Small Patients

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• Aortic outflow graft shortening
  – Helps prevent looping or kinking of the graft
  – Removal of support rings

• Atrial cannulation (RVAD, single ventricle)
  – Less dissection
  – Utilize right pleural space
HVAD Management
*Small Patient Considerations*

- More frequent suction-like events due to size of chest cavity with respect to device
  - Crying, coughing, sleeping
  - Self-resolving

Ventricular Assist after Fontan

- New frontier
- Minimal data
- Case reports, case series, single institution

HeartWare in Single Ventricle Patients

**GOAL:** Minimize Inflow Obstruction

- Felt Spacers
- Atrial cannulation
HeartWare in Single Ventricle Patients

GOAL: Minimize Inflow Obstruction

- Felt Spacers
- Atrial cannulation
- AV valve excision

HVAD Management

Single Ventricle Considerations

- Anatomical Issues
  - TV “interference”
    - Notch on waveform
    - Suction appearance
  - TV Removal → waveform change
    - Similar to RVAD
    - Negative deflections indicative of suction
HVAD Management
_Single Ventricle Considerations_

• Requires higher speeds
  – Complete reliance on HVAD for output
  – Moving entire blood volume
• Need for vasodilation
  – Make it easier for VAD to pump
• Need for diuresis
  – VAD has to move all the volume

HeartWare for Biventricular Support

PATIENT 1
• 16 yo, 55 kg
  – Acute myocarditis
  – ECMO for card. shock
• HVAD BiVAD
  – LV apex
  – Diaphragmatic surface RV
• Height of RVAD altered for depth control

PATIENT 2
• 16 yo, 50 kg
  – HCM & Friedreich’s Ataxia
  – ECMO for low cardiac output
• 3 days after ECMO → HVAD LVAD (LV apex)
• 4 days after LVAD → HVAD RVAD (R atrium)
What to Expect
BiVAD Considerations

- RVAD waveform generally non-pulsatile
  - Dependent on the amount of underlying RV fxn.
- Can see flows RVAD > LVAD and have this be clinically insignificant

Conditioning for Transplant

- Improve: musculoskeletal conditioning and reserve

GOAL: Extubate sooner, ambulate sooner, discharge sooner!

Summary

- Great success with the use of the HeartWare HVAD
  - Less issues with thrombus
  - Multiple modalities
  - Patients can be discharged to home

Questions?