Centrifugal VAD

Does it have a future?

The R.C.H. Spin.
History


- Minimisation of biological tolerance of the trauma to blood.
- Adequate flow and pressure.
- Pulsatile flow?
- Positive displacement (insensitivity to flow resistance).
- Variable displacement and cycling speed.
- Absence of internal valves.
- Simplicity of adjustment.
- Continuous measurement of output.
- Minimal priming volume.
History

History


- RCH: first VAD, May 1989.  4 month old ALCAPA
Why VAD?

- Simplicity.
- Cost.
- Long term outcome.
Neurologic Impairment for ECMO and VAD supported pediatric patients with cardiac disease.

Ibrahim A.E, Duncan B.W, Blume E.D & Jonas R.A.

![Graph showing comparison between ECMO and VAD-supported patients.](image)

- Normal or mildly impaired
- Moderately or severely impaired

P = 0.03
In current clinical use

- Biomedicus Biopump
- Terumo Capiox
- Jostra Rotaflow
- St Jude Lifestream
- Heartmate
- Nikkiso
- Cardiac Assist iVAD & pVAD
- Medos Deltastream
- CorAide
- VentrAssist
Cardiac Assist Pump System

- Delivers up to 6 liters per minute flow
- Lightweight - 280 grams
- Compact - accommodates a wide range of patients
- 7ml priming volume
Heartmate
Medos DeltaStream Pump

- Cross between axial and centrifugal.
- Pulsatile flow option.
CorAide Pump

- No Seals
- Implantable
CorAide Pump
Ventralist Assist Pump

- Magnetic suspension with hydrodynamic bearing.
- No seals
- Diagonal flow impeller
- Passively suspended rotor.
RCH VAD Results

- n = 75
- 49 weaned  (0.69, CI : 0.59 – 0.81)
- 32 discharged  (0.43, CI : 0.31 – 0.55)
- Median age: 3.0 months (2 days – 19 years)
- Median weight: 4.6 kg  (1.9 – 70 kg)
RCH VAD Details

• Median support time: 75 hours (1 - 428) **weanable**
• Median support time: 79.5 hours (2 - 114) **not weanable**
• Median support time: 73.5 hours (38 - 144) **discharged**
• Median support time: 91 hours (19 - 428) **not discharged**

• Median CPB time: 208 min (181 - 235)
• Median X Clamp time: 70 min (58 - 82)
• Median CPB time: 85 min (8 - 654) **All patients**
• Median X Clamp time: 41 min (0 - 369) **All patients**
ELSO ECMO Results  ➔ July 2000

- N = 21,547 (total)
- 3159 children in cardiac category (14.7%)
- 2451 cardiac surgery prior to support
- 205 transplant related indication
- 108 myocarditis
- 219 other coagulopathies
- 494 other
- 1696 weaned (0.537, CI: 0.519 - 0.554)
- Overall survival 1242 (0.393, CI: 0.376 - 0.510)
ELSO ECMO Results ➔ July 2000

- RCH (0.36) wean
- ELSO (0.54) wean
- RCH (0.21) discharge
- ELSO (0.39) discharge
- RCH VAD (0.69) wean
- RCH VAD (0.43) discharge
- RCH ECLS (0.53) wean
- RCH ECLS (0.34) discharge
The Future

- Germany
- Austria
- Japan
- China
- Taiwan
- Korea
- U.S.A.
- Singapore
- Australia
McGowan Nimbus Pump

- Designed for paediatrics
- 13 ml prime volume
- 0.3-3.0 lpm flow.
- Single use.
- 1/4” ports
Gyro Pump

- No Seals
- Double pivot bearing
- Eccentric inlet port
Other devices under development.

- HiFlow pump, Helmholtz Institute
- Evaheart centrifugal blood pump. Sun Medical Technology Research Corp & Pittsburgh University.
- HeartMate III LVAD. TCI/Nimbus Inc & Pittsburgh University.
- Vienna pump. Vienna University
- Abiomed CF. Abiomed Inc.
- Kriton pump. Kriton Medical Inc.
- MSCP pump. Terumo Corporation & Setsunan University.
- HeartQuest pump. MedQuest Products Inc.
HeartQuest pump
Is this the future?
Impella Recover
Impella Acute
Impella
DeBakey
Jarvik 2000
Berlin Heart Incor
Conclusion

Neurological follow-up suggests VAD does less harm than ECMO for short term support.

Centrifugal VAD is cost effective for short term support.

If micro-axial pumps become less expensive they may become cost effective for short term support.