Overview

• Internally implanted
  • Pump placed directly into left ventricle
    • No pocket, no inflow cannula
  • Typically, placed via L thoracotomy with outflow to descending aorta
    • Occasionally, sternotomy with outflow to ascending aorta
  • Driveline exits RUQ
    • Keep dry, change dressing weekly and PRN
    • Anchor drive line
Overview

Å Electric
  • Battery driven

Å Speed:
  • 1 = 8,000 rpm ~ 1-1.5 lpm flow
  • 5 = 12,000 rpm; up to ~5-6 lpm flow

Å Medium- to long-term therapy (months to years)
  • Bridge to Transplant
Key Parameters

- Non-pulsatile
- Speed
  - Determines amount of flow
  - Determined by ECHO
  - Decompress LV
  - Controller runs on 1 battery at a time only
  - May have different speeds for rest, and exertion
  - Intermittent Low Speed (ILS): pump slows self to wash out aorta arch:
    - 8 sec per minute
Key Parameters

Å Pump Power

⁻ Power to run the device (watts)
⁻ Range 3-13 watts
⁻ ↑ power with increase speed or preload
⁻ ↑ power at same speed: possible thrombus or controller dysfunction
⁻ ↓ power at same speed: check battery
⁻ May blink in time with patient's heart rate

Å May be indicator of native heart pulsatility
Controller “Brain”
FlowMaker™ Controller

- Underspeed Indicator Light
- (Power Indicator Lights) Lighted Numbers Show Approximate Power in Watts
- Pump Stopped Alarm Light
- Number Indicates Speed Settings
- Low Battery Indicator
- Pump Speed Symbol
- Speed Setting Knob
Cables

Abdominal Cable                      Y Battery Cable                Li-Ion Battery cable (Pigtail)
Power Source

**Battery Only**
- Reserve battery
  - 24 hours
  - Change q12h
- Li Ion battery
  - 8-12 hours
  - Change when at red or yellow

**Daily battery checks**
- D/C battery x 1 sec
- Should cause alarms
- IF not: check alarm battery connection / change alarm battery

**Controller needs to be on one battery at all times**
Batteries

Li-Ion- Portable Battery
Provides 8 to 12 hours of Power
Charged with a separate charger

Reserve Battery
Can provide >24 hours of Power
Only use for 12 hrs at a time
Has a built in charger

Alarm Battery
Located on the side of the Controller
Sounds the Alarm if battery power fails or is disconnected. Will not RUN the pump.
Battery Chargers

**Li-ion**
The Pigtail cable must be removed and the charger cable inserted in its place.

Yellow LED light flashes while charging then will glow steady green when charge cycle complete.

Will charge a fully discharged battery in approx. 5 hours.

**Reserve**
Charger is Built-in.

To charge the grey cable must be plugged into the grey receptacle on the top of the battery unit.

A yellow LED light will glow constant during the charge cycle then go out when fully charged.

Charge time is approx. 8 to 12 hours.
What You Need to Know

• Faint or no palpable pulse
  - Noisy / Artifact EKG

• Faint or no palpable BP
  - May need to use doppler
  - MAP 65-80 mmHg
  - Narrow or no pulse pressure

• Hypertension
  - Impairs output

• Hypotension
  - Suckdown if speed is too high

• Auscultate VAD: routine assessment
You Need to Know

**Backup Equipment:**
- Spare controller
- Spare cables (1 abdominal; 3 total Li-Ion; 1 Y)
- Batteries (at least 2 Reserve, 3 Li-Ion, 1 alarm battery)
- Li-Ion Charger
- Patients readmitted from home are responsible for bringing all of this in with them

**Travel Procedures:**
- Spare controller with full set of cables (black abdominal, gray Y-cable, Li-Ion cable)
- At least one extra battery
Device Alarms

A Low Battery Alarm:

- Yellow light and beeps
- Li Ion 5-10 minutes
- Reserve over 15 minutes
Device Alarms

Å Underspeed Indicator

- Pump running slower than speed indicates
- Cause:
  - Battery voltage: change battery
  - External components dysfunction: change equipment
- Contact VAD Team
Device Alarms

Å Pump Stop Alarm:

- Pump Stops or speed < 5000 rpm
- Red Alarm, steady sound
- Check all connections
- Change out controller
- Call VAD team
Emergency Procedure

- No need to disconnect power / controller to defibrillate
- CPR: chest compressions as last resort
- Notify VAD team for any change in status
Replacing the Controller

- Ensure spare abdominal (black) and Y (grey) cables are attached to backup controller
- Attach a new battery (any kind, just not the one currently on the patient) to the Y cable on the backup controller
  - backup controller will alarm "Pump Stop" and "Underspeed"
- Detach abdominal cable connection for malfunctioning controller at patient (connection most proximal to exit site)
- Attach backup controller abdominal cable at patient
  - backup controller should cease alarming
- Remove battery from malfunctioning controller
- Unscrew alarm battery cover on malfunctioning controller until "Pump Stop" alarm ceases
- Ensure controller attached to patient is set at correct speed
- Auscultate VAD to ensure operating properly
- Tighten cap on alarm battery & test for proper function