

Ventricular Assist Device & Mechanical Circulatory support (VAD & MCS)

Introduction

- Stage D HF (Advanced HF or End-stage heart disease) defined by "Refractory symptoms at rest or minimal exertion, despite GDM", usually with repeat HF hospitalization and multi-organ failure eg. CKD, PH, cirrhosis, and cardiac cachexia.
- Recognizing the transition to stage D HF allows patient to consider Rx options include MCS

Rx options for stage D HF

1. Heart transplant
2. VAD & MCS
3. Chronic home inotrope
4. Palliative care
5. Experimental meds, Sx

Type and Classification

- Duration of support: Non-durable (short-term) vs Durable (long-term)
- Flow characteristic: Pulsatile vs Continuous flow
- Degree of support: Partial vs Full support
- Implant approach: Percutaneous (bedside, cath lab) vs Open (surgery) placement
- Pump location: Intra vs Paracorporeal vs Extracorporeal pump
- Type: LVAD, RVAD, ECMO, TAH
- "Generation": 1st (pulsatile), 2nd axial continuous flow, 3rd centrifugal continuous flow

Indication (circ 2012;126:2648)

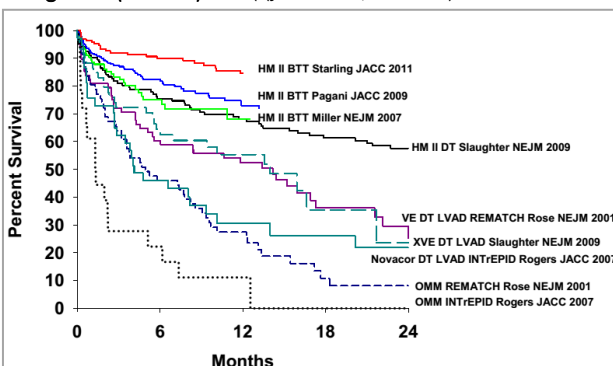
- Bridge to transplant (BTT)
- Destination therapy (DT)
- Bridge to ...
 - Recover eg. myocarditis acute MI, post cardiac surgery, shock.
 - Periprocedure eg. high risk PCI, valve intervention, ablation.
 - Decision eg. OHT candidacy status.

Commonly use MCS (*available at KCMH)		
	Short term	Long term
Pulsatile flow	IABP* BerlinHeart*	HeartMate XVE pVAD TAH
Continuous flow	CentriMag* ECMO* Impella TandemHeart	HeartMate II* HVAD

Short-term (Non-durable) MCS

- IABP is the most commonly use MCS but the benefit is questionable in PCI present era.
- Newer device (such as Impella, TandemHeart) have been associated with better hemodynamics but not survival when compared to IABP. (Eur Heart J 2014;35:156)

Long-term (durable) MCS((jacc 2015;65:2542)



- REMATCH (nejm 2001) established DT indication
 - 129 stg D HF who is not a transplant candidates, randomized to HM XVE vs medical therapy
- Pulsatile flow LVAD is hardly used now. (nejm 2009;361:2282)
- 1 yr survival comparative to OHTx (85-90%)
- Median survival = 3.5-4 yrs
- Also improve QoL (80% NYHA I-II)
- Most available data and most commonly use LVAD is HM II

Patient selection

- In 2015, > 50% of long term LVAD are implanted in patient with INTERMACS 3, 4.
- ~ 40% of OHTx recipients were on MCS prior to transplant.
- Many risk scores for patient selection such as Lietz-miller (circ 2007), HMRS (jacc 2013;61:313)

Profile	Description	Time to MCS
1	"Crashing and burning" - critical cardiogenic shock.	Within hours
2	"Progressive decline" - inotrope dependence with continuing deterioration.	Within a few days
3	"Stable but inotrope dependent" - describes clinical stability on mild-moderate doses of intravenous inotropes. (Patients stable on temporary circulatory support without inotropes are within this profile).	Within a few weeks
4	"Recurrent advanced heart failure" - "recurrent" rather than "refractory" decompensation. "Resting symptoms"	Within weeks to months
5	"Exertion intolerant" - describes patients who are comfortable at rest but are exercise intolerant.	Variable
6	"Exertion limited" - a patient who is able to do some mild activity but fatigue results within a few minutes or any meaningful physical exertion.	Variable
7	"Advanced" - describes patients who are clinically stable with a reasonable level of comfortable activity, despite history of previous decompensation that is not recent.	Not a candidate for MCS

Continuous-flow VAD (include HM II) management

- Low or no pulse pressure - No pulses
 - Using Doppler or arterial line for MAP
- VAD parameters
 - Speed (8000-10000 rpm): Physician sets a fixed speed VAD will be running at
 - Power (5-7 watts): How much energy, the pump uses to generate the set speed.
 - Flow estimator (---, 5-7, +++ L/min): Calculated from speed and power. May not be accurate.
 - Pulsatility Index (3-5): A calculation of flow pulsatility. Determined the degree of native LV contractility. $PI = [(flow\ max - flow\ min)/flow\ average] \times 10$
- Coumadin + ASA
- Care of the percutaneous lead (drive line dressing daily)
- BP control, goal doppler BP = 60-80 mmHg
- HF and arrhythmia treatment

Complication events/yrs (JACC. 2009;54:312)

- Infection 5-25%, RV failure 10%, Stroke 10% (embolic vs hemorrhagic), GI Bleeding 5%
- Pump thrombosis/malfunction (rare), AI, VT/VF
- Overall complication = 50-70% within 1st year after implant (mostly infection)

Newer device

- Smaller, partial support, full implant, non-cardiac targeted support.

Recommend Readings

- Left Ventricular Assist Devices. JACC 2015;65:2542.
- Recommendations for the Use of MCS. Circ 2012;126:2648.
- Clinical management of continuous-flow LVAD in advanced HF. JHLT 2010;29:S1.
- Guideline - ISHLT 2013. SCAI/AC/HFSA/STS for percutaneous MCS 2015.