ΤΕΛΙΚΟΥ ΣΤΑΔΙΟΥ ΚΑΡΔΙΑΚΗ ΑΝΕΠΑΡΚΕΙΑ:
ΤΟ ΤΕΛΟΣ ΤΗΣ ΔΙΑΔΡΟΜΗΣ

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Heart Failure and Transplant Unit
Onassis Cardiac Surgery Centre
- Educational Grant from European Heart Academy
- Grants as a speaker from Novartis, Medtronic and Abbott
IMPACT AND PROGRESSION OF HEART FAILURE
### A SERIOUS AND GROWING PROBLEM

<table>
<thead>
<tr>
<th>1 in 5</th>
<th>lifetime risk of developing heart failure at 40 years of age(^1,2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>~50%</td>
<td>of people diagnosed with heart failure die within 5 years(^3)</td>
</tr>
<tr>
<td>20%</td>
<td>readmitted within 30 days(^4)</td>
</tr>
</tbody>
</table>
Heart Failure Treatment Algorithm 1

Stage D has a 30-78% mortality/year

Palliative care

Mechanical circulatory support: Short-term (for acute exacerbation HF, cardiogenic shock), durable device, transplantation

Inotropes, vasodilators, IV diuretics, antiarrhythmics as needed

Renal replacement therapy if unresponsive to IV diuretics

Aldosterone antagonist/MRA, vasodilators

Consider multidisciplinary team

Revascularization, valve surgery

Consider ICD or CRT device in patients with EF ≤ 30%, QRS ≥ 150 msecs, or LBBB

Dietary sodium restriction, diuretics, and digoxin (hydralazine, nitrates in black patients)

Consider discontinuing ACE or ARB and replace with ARNI

Uptitrate ACE, ARB, ARNI to maximum tolerated, evidenced-based dose

Consider ICD or CRT device in patients with EF ≤ 30%, QRS ≥ 150 msecs, or LBBB

Consider sleep apnea study and treatment

Treat hypertension, diabetes, dyslipidemia, anemia

Beta-blockers or MRA, ACE inhibitors, ARBs, or ARNI in some patients

Risk-factor reduction, patient and family education

1.8% of Western European (WE) population suffers from heart failure. 

= ~8.5 Million

Around 45% of the patients have HF NYHA class III/IV. 

= ~3.8 Million

ABOUT 1,888 HEART TRANSPLANTS IN WE 2016


2 Global Public Health Burden of Heart Failure, Gianluigi Savarese and Lars H Lund, Karolinska Institute, Stockholm 2016-2017

LVAD population - Bridge-to-transplant
Patients annually hospitalized for HF (100%)

- Patients older than 75 years (75%)
- Patients younger than 75 years (25%)

In-hospital death due to HF (7%)

- Patients not re-hospitalized within 12 months (50%)
- Patients re-hospitalized within 12 months (50%)

In-hospital survival (93%)

- Patients with ejection fraction > 25% (74%)
- Patients with ejection fraction < 25% (26%)

Every year an estimated 44 to 52 new patients per million of population in Western Europe are indicated for LVAD therapy*

BETWEEN 17.996 AND 21.264 NEW PATIENTS EVERY YEAR*

*Calculations based on:
1. Qualitätsbericht der Krankenhäuser für das Jahr 2016
4. National Heart Failure Audit, April 2015 – March 2016
5. Herzbericht 2017
7. ADHERE-Comparison of Clinical Feature and Outcomes by EF- 2008 (Acute Decompensated Heart Failure National Registry), US data
8. Clinical Exclusions are based on the estimation from the ADHERE Study Design and Preliminary Observations - 2005 (Acute Decompensated Heart Failure National Registry), US data
VAD THERAPY IS UNDERUTILIZED IN ADVANCED HF PATIENTS

Only ~7.7 – 9.2% of new patients eligible for a VAD receive the technology*

More than 8.5 Million HF patients in Western Europe

Around 17,996 – 21,264 new patients every year who could benefit from a LVAD*

1,654 LVAD implantations in Western Europe 2017

*Calculations based on:
1 Qualitätsbericht der Krankenhäuser für das Jahr 2016
4 National Heart Failure Audit, April 2015 – March 2016
5 Herzbericht 2017
7 ADHERE-Comparison of Clinical Feature and Outcomes by EF- 2008 (Acute Decompensated Heart Failure National Registry), US data
8 Clinical Exclusions are based on the estimation from the ADHERE Study Design and Preliminary Observations - 2005 (Acute Decompensated Heart Failure National Registry), US data
11 Estimated number from competitive intelligence
Total cost of cancer in the European Union

The total cost of cancer in the European Union is more than the entire EU budget.

In billion (BN) euros in 2009

- Cancer-related health-care costs: € 51 BN
- Productivity losses due to mortality: € 42.7 BN
- Informal care costs – monetary value of unpaid care provided by family or friends: € 23.2 BN
- Productivity losses due to morbidity: € 9.4 BN

Total 

€ 126.2 BN

EU BUDGET

Total 

112 BN
Cancer Costs in Europe

Cancer Costs in Europe

Healthcare delivery
- €51 billion (40%)
Productivity losses
- €42.6 billion (34%)
Lost working days
- €9.43 billion (7.5%)
Informal Care**
- €23.2 billion (18.4%)

In EU outpatient cancer costs – including radiation oncology – account for 11% of total healthcare spending on cancer.

*the ESTRO toolkit refers to data in 2009, newer data can be found e.g. in Source 4
**costs of unpaid care provided by relatives or friends of patients

The biggest and most costly cancer killers in Europe...

... include the following cancer cases in 2012:

Lung
- €18.8 billion
- 15% of total costs
- 353,000 deaths

Breast
- €15 billion
- 12% of total costs
- 131,000 deaths

Colorectal
- €13.1 billion
- 10% of total costs
- 215,000 deaths

Prostate
- €8.43 billion
- 7% of total costs
- 92,000 deaths

Source 1 and 4

Source 1
VENTRICULAR ASSIST DEVICE THERAPY
## What Devices Do We Have?

<table>
<thead>
<tr>
<th></th>
<th>HeartMate II</th>
<th>HVAD</th>
<th>Jarvik 2000</th>
<th>HeartMate 3</th>
<th>MVAD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Implant Location</strong></td>
<td>Chest/abdomen</td>
<td>Pericardial</td>
<td>Pericardial/intra-cardiac</td>
<td>Pericardial</td>
<td>Pericardial</td>
</tr>
<tr>
<td><strong>Flow Configuration</strong></td>
<td>Axial</td>
<td>Centrifugal</td>
<td>Axial</td>
<td>Centrifugal</td>
<td>Axial</td>
</tr>
<tr>
<td><strong>Impeller suspension</strong></td>
<td>Mechanical bearing</td>
<td>Hybrid Magnetic/hydrodynamic</td>
<td>Ceramic Bearing</td>
<td>Magnetically Levitated</td>
<td>Magnetically Levitated</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>281 grams</td>
<td>160 grams</td>
<td>90 grams</td>
<td>220 grams</td>
<td>78 grams</td>
</tr>
<tr>
<td><strong>Maximum Output</strong></td>
<td>10 L/m</td>
<td>10 L/m</td>
<td>7 L/m</td>
<td>10 L/m</td>
<td>7 L/m</td>
</tr>
<tr>
<td><strong>Artificial Pulsatility</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Typical Speed Range</strong></td>
<td>8,000-10,000 RPM</td>
<td>2,000-4,000 RPM</td>
<td>8,000-12,000 RPM</td>
<td>3,000-9,000 RPM</td>
<td>8,000-18,000 RPM</td>
</tr>
</tbody>
</table>

Fried J / Uriel N Structural Heart Journal 2018
HeartMate 3 LVAS
Management of Heart Failure patient

Clinical factors
- History and exam
- Etiology
- Exertional tolerance
- Hospitalization
- Frailty

Quality of life
- Goals of care
- Advanced directives

Laboratory
- Sodium
- End-organ function
- Hematologic
- Nutritional

Hemodynamic
- Pulmonary hypertension
- Systemic vasoplegia
- Right heart failure
- Low output

Mortality Models
- SHFM
- HFSS
- LVAD/transplant risk

Imaging
- Ventricular size
- Fibrosis
- MR and TR
- RV function

### Guidelines for LVAS
Provide indications

#### 2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

**Table 13.3** Patients potentially eligible for implantation of a left ventricular assist device

<table>
<thead>
<tr>
<th>Patients with &gt;2 months of severe symptoms despite optimal medical and device therapy and more than one of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEF &lt; 25% and, if measured, peak VO2 &lt; 12 mL/kg/min.</td>
</tr>
<tr>
<td>≥3 HF hospitalizations in previous 12 months without an obvious precipitating cause.</td>
</tr>
<tr>
<td>Dependence on i.v. inotropic therapy.</td>
</tr>
<tr>
<td>Progressive end-organ dysfunction (worsening renal and/or hepatic function) due to reduced perfusion and not to inadequate ventricular filling pressure (PCWP ≥ 20 mmHg and SBP ≤ 80–90 mmHg or CI ≤ 2 L/min/m²).</td>
</tr>
<tr>
<td>Absence of severe right ventricular dysfunction together with severe tricuspid regurgitation.</td>
</tr>
</tbody>
</table>

**Recommendations for implantation of mechanical circulatory support in patients with refractory heart failure**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Classa</th>
<th>Levelb</th>
<th>Refc</th>
</tr>
</thead>
<tbody>
<tr>
<td>An LVAD should be considered in patients who have end-stage HFREF despite optimal medical and device therapy and who are eligible for heart transplantation in order to improve symptoms, reduce the risk of HF hospitalization and the risk of premature death (Bridge to transplant indication).</td>
<td>IIA.</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>An LVAD should be considered in patients who have end-stage HFREF despite optimal medical and device therapy and who are not eligible for heart transplantation to, reduce the risk of premature death.</td>
<td>IIA.</td>
<td>B</td>
<td>605, 612, 613</td>
</tr>
</tbody>
</table>
Timing is everything
But timing is difficult
PROGRESSIVE NATURE OF HEART FAILURE

- Overall, 50% of heart failure patients do not survive beyond four years.
- 40% of patients hospitalized with HF do not survive or are readmitted within one year.

Variability of NYHA Class IV/Stage D HF

- Stable on IV Meds
- Refractory/shock Despite IV Meds
- Sick HF, Cachexia Frequent Admits
- Stable, Low VO2 Drug Trials
- Class IV/Stage D HF
# Intermacs classification

<table>
<thead>
<tr>
<th>INTERMACS level</th>
<th>NYHA Class</th>
<th>Description</th>
<th>Device</th>
<th>1y survival with LVAD therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cardiogenic shock “Crash and burn”</td>
<td>IV</td>
<td>Haemodynamic instability in spite of increasing doses of catecholamines and/or mechanical circulatory support with critical hypoperfusion of target organs (severe cardiogenic shock).</td>
<td>ECLS, ECMO, percutaneous support devices</td>
<td>52.6±5.6%</td>
</tr>
<tr>
<td>2. Progressive decline despite inotropic support “Sliding on inotropes”</td>
<td>IV</td>
<td>Intravenous inotropic support with acceptable blood pressure but rapid deterioration of renal function, nutritional state, or signs of congestion.</td>
<td>ECLS, ECMO, LVAD</td>
<td>63.1±3.1%</td>
</tr>
<tr>
<td>3. Stable but inotrope dependent “Dependent stability”</td>
<td>IV</td>
<td>Haemodynamic stability with low or intermediate doses of inotropics, but necessary due to hypotension, worsening of symptoms, or progressive renal failure.</td>
<td>LVAD</td>
<td>78.4±2.5%</td>
</tr>
<tr>
<td>4. Resting symptoms “Frequent flyer”</td>
<td>IV ambulatory</td>
<td>Temporary cessation of inotropic treatment is possible, but patient presents with frequent symptom recurrences and typically with fluid overload.</td>
<td>LVAD</td>
<td>78.7±3.0%</td>
</tr>
<tr>
<td>5. Exertion intolerant “Housebound”</td>
<td>IV ambulatory</td>
<td>Complete cessation of physical activity, stable at rest, but frequently with moderate fluid retention and some level of renal dysfunction.</td>
<td>LVAD</td>
<td>93.0±3.9%</td>
</tr>
<tr>
<td>6. Exertion limited “Walking wounded”</td>
<td>III</td>
<td>Minor limitation on physical activity and absence of congestion while at rest. Easily fatigued by light activity.</td>
<td>LVAD / Discuss LVAD as option</td>
<td>-</td>
</tr>
<tr>
<td>7. “Placeholder”</td>
<td>III</td>
<td>Patient in NYHA Class III with no current or recent unstable fluid balance.</td>
<td>Discuss LVAD as option</td>
<td>-</td>
</tr>
</tbody>
</table>

Modifiers:
- A: arrhythmias
- TCS: temporary mechanical support (only for patient profile 1,2 and 3)
TIMING OF PATIENT CONVERSATIONS
& PATIENT SELECTION
GIVING YOUR PATIENTS TIME TO CONSIDER VAD THERAPY

WHEN SHOULD DISCUSSIONS ABOUT VAD THERAPY OCCUR?

From the first consideration of a VAD, emphasis should be placed on the anticipated differences between ongoing medical therapy and VADs with respect to both survival and quality of life. These discussions should occur before consideration of continuous outpatient inotropic infusions for hemodynamic support of deteriorating clinical status.¹

Life with an LVAD

How long might I live?
Patients usually live longer with an LVAD.
After 1 year, about 8 out of 10 patients who got an LVAD are still alive.¹

Life without an LVAD

How long might I live?
Patients usually do not live as long without an LVAD. After 1 year, almost 2 out of 10 patients who did not get an LVAD are still alive.¹
<table>
<thead>
<tr>
<th>Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulsatile LVAD</td>
<td>52%</td>
</tr>
<tr>
<td>Medical therapy</td>
<td>25%</td>
</tr>
</tbody>
</table>

1-year alive
If you are very sick with heart failure, especially if you are on inotropes or have discussed advanced therapy: You will live longer with a VAD.
How to Select Patients for VAD?

- not tolerating optimal HF medical therapy
- >2 HF admissions
- cardiorenal syndrome
- persistent poor exertional tolerance/major lifestyle adjustments
- worsening pulmonary hypertension

This HF patient is in trouble: Refer him to be evaluated!

One or more of the following risk factors should trigger clinician to refer their patient to an advanced heart failure center:\textsuperscript{2}

- Systolic blood pressure $\leq 90$ mmHg
- Creatinine $\geq 160$ µmol/l ($>1.8$ mg/dl)
- Hemoglobin $\leq 120$ g/l ($<12.0$ g/dl)
- No treatment with renin-angiotensin system antagonist
- No treatment with beta-blocker

Selection algorithm
Lund in Bartunek, ed. 2015

NYHA III-IV and EF ≤ 30%
Optimal medical therapy
CRT if indicated, ICD

Refer to HTx / LVAD center

Critical cardiogenic shock
INTERMACS 1

Inotrope dependent
INTERMACS 2-3

Recurrent hospitalization
Progressive organ failure
Unable to perform peak VO2, NYHA IV

Stable Ambulatory
INTERMACS 4-7

Short-term MCS

Cardiac, neurological and organ recovery:

Priority HTx
LVAD BTT
LVAD DT

Neurological and organ recovery but not cardiac recovery

HTx
LVAD DT

Poor neuro status,
Severe irreversible organ failure

STOP

NYHA IIIB-IV
Peak VO2 < 10-12-14
HFSS med-hi risk
SHFM or MAGGIC calculated < 80 % 1-year survival (<75% actual)

yes

no

Reassess every 3-6 months
Despite optimal medical management, patients continue to be readmitted to the hospital for acute heart failure symptoms, becoming a “frequent flyer” and potentially inotrope-dependent. 

50% of those who have three hospital stays will die within one year.

---

~\frac{2}{3}\text{ of all heart failure-associated costs in the EU are due to hospitalisation}
HF Direct cost

For each patient, the estimated total lifetime direct cost of heart failure is nearly $110,000²*
INOTROPES ARE AN IMPERFECT SOLUTION

COSI STUDY — HIGHLIGHTS

36 inotrope-dependent stage D heart failure patients

RESULTS

Re-hospitalizations = 46

Median survival = 3.4 months

1 year survival = 6%

Any patient who is considered for chronic inotropic therapy, and who otherwise has a reasonable prognosis for 3 to 5 years, should first be evaluated for candidacy for chronic LVAD therapy or transplant.

Inotropes can alleviate symptoms but are associated with no reduction in recurrent hospitalization and as high as 80% mortality at 1 year.

---


IS IMPORTANT

Earlier ventricular assist device implantation in less severely ill patients and before right ventricular or multi-organ failure develops, leads to better surgical outcomes.\(^2\)

Referral before right ventricular failure develops is preferable.\(^1\)

Right Heart Central to LVAD Decisions

No “destination” options for right heart

Echo Signs
- TAPSE <13mm
- Severe TR
- RV dysfunction

Blood lab signs
- Hepatic: low albumin, high INR
- Renal: High Cr, low GFR

Right heart failure after LVAD carries ~6x >mortality

Few Treatment Options:
- RVAD, inhaled NO, inotropes

Hemodynamic Signs
- RA~PCWP
- RA>10
- Low RVSWI
Evaluation of RV function

- ECHO: RV dimension, TAPSE, longitudinal strain, TR
- Vasopressor use
- Non-Ischemic Etiology - 4X increase in risk
- Female gender
- Creatinine ≥ 2.3mg/dl, 203 umol/l
- Bilirubine ≥ 2.0mg/dl, 39 mmol/l
- ASAT ≥80 IU/l
- RA>20 on Rx, RA> 2/3 PCW, PCW <20,
- PVR >5 WU, TPG >16, PAS >70, CI< 1.8 L/min
- PAPi: \( \frac{PA_{syst} - PA_{diast}}{RA} \leq 2 \)
- RVSWI < 300; (PA mean-RA) x SVI
When is the best moment to implant a LVAD?

<table>
<thead>
<tr>
<th>Metric</th>
<th>%</th>
<th>35</th>
<th>30</th>
<th>25</th>
<th>20</th>
<th>15</th>
<th>&lt;10</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LVEDD</td>
<td>mm</td>
<td>65</td>
<td>70</td>
<td>75</td>
<td>80</td>
<td>85</td>
<td>&gt;90</td>
</tr>
<tr>
<td>CI</td>
<td>L/min/m²</td>
<td>2.4</td>
<td>2.2</td>
<td>2</td>
<td>1.8</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>CVP</td>
<td>mmHg</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>18</td>
<td>&gt;20</td>
</tr>
<tr>
<td>APACHE II</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>11-15</td>
<td>11-15</td>
<td>16-20</td>
<td>&gt;20</td>
<td></td>
</tr>
<tr>
<td>Inotropes</td>
<td>days</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2-4</td>
<td>5-10</td>
<td>&gt;10</td>
</tr>
<tr>
<td>Billirubin</td>
<td>&lt;1</td>
<td>&lt;1.5</td>
<td>&lt;2</td>
<td>&lt;3</td>
<td>&lt;5</td>
<td>&gt;5</td>
<td></td>
</tr>
<tr>
<td>RVEF</td>
<td>%</td>
<td>&gt;40</td>
<td>&gt;40</td>
<td>&gt;35</td>
<td>&gt;30</td>
<td>&gt;25</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Ventilation</td>
<td>days</td>
<td>0</td>
<td>0</td>
<td>&lt;1</td>
<td>1-3</td>
<td>4-6</td>
<td>&gt;7</td>
</tr>
<tr>
<td>MCS</td>
<td>days</td>
<td>0</td>
<td>0</td>
<td>&lt;1</td>
<td>1-3</td>
<td>4-6</td>
<td>&gt;7</td>
</tr>
<tr>
<td>MOF</td>
<td>organs</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>&gt;3</td>
</tr>
</tbody>
</table>
Frailty and outcome after LVAD. JHLT 2014;33:359-65

![Graph A: Frailty and outcome after LVAD](image1)

- Not Frail: 28, 24, 27, 17
- Intermediate Frail: 26, 24, 17, 14
- Frail: 22, 19, 14, 11

![Graph B: Frailty and outcome after LVAD](image2)

- Not Frail: 28, 24, 27, 17
- Intermediate Frail: 26, 24, 17, 14
- Frail: 22, 19, 14, 11
TIME TO CONSIDER VAD THERAPY

1. Two readmissions within the past year
2. Inotrope dependent
3. Medical therapy optimized
4. EF < 35%

References:
CLINICAL OUTCOMES
**Examples of MCS**

| Bridge to decision (BTD)/Bridge to bridge (BTB) | Use of short-term MCS (e.g. ECLS or ECMO) in patients with cardiogenic shock until haemodynamics and end-organ perfusion are stabilized, contra-indications for long-term MCS are excluded (brain damage after resuscitation) and additional therapeutic options including long-term VAD therapy or heart transplant can be evaluated. |
| Bridge to candidacy (BTC) | Use of MCS (usually LVAD) to improve end-organ function in order to make an ineligible patient eligible for heart transplantation. |
| Bridge to transplantation (BTT) | Use of MCS (LVAD or BiVAD) to keep patient alive who is otherwise at high risk of death before transplantation until a donor organ becomes available. |
| Bridge to recovery (BTR) | Use of MCS (typically LVAD) to keep patient alive until cardiac function recovers sufficiently to remove MCS. |
| Destination therapy (DT) | Long-term use of MCS (LVAD) as an alternative to transplantation in patients with end-stage HF ineligible for transplantation or long-term waiting for heart transplantation. |

“Designation of these categories at the time of implantation is an exercise in predicting the future”
PATIENT SURVIVAL AND QUALITY OF LIFE IMPROVED

When managing a patient with advanced heart failure, consider discussing referral for VAD therapy while the patient still has time to make the choice.

The overall survival of patients receiving continuous flow LVADs

81% at 12 months and

70% at 24 months

Patients experience early and sustained improvements in life and functional capacity.

More practical look at MCS

End-stage heart failure → Durable support →

- Never HTx
- HTx at some time
- Recovery
Conclusion

- Intermacs 1: short term device: ECLS, Centrimag
- Intermacs 2+3: durable MCS
- Intermacs 4: consider durable MCS
- Estimation of prognosis in HF is extremely difficult
- Estimation of prognosis in acute HF is even more difficult
- Predicting RV failure in LVAD therapy, is the biggest challenge
### Intermacs Profile at Implantation

#### Official Shorthand

<table>
<thead>
<tr>
<th>Intermacs Profile-Level</th>
<th>% of VADs 2010-11 N=2245</th>
<th>Trial Subjects With LVADs</th>
<th>Official Shorthand</th>
<th>Modifier Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermacs 1</td>
<td>13%</td>
<td></td>
<td>“Crash and burn”</td>
<td>+ Arrhythmia, + Temporary Circ Support</td>
</tr>
<tr>
<td>Intermacs 2</td>
<td>42%</td>
<td></td>
<td>“Sliding fast” despite inotropic support</td>
<td>+ Arr, TCS</td>
</tr>
<tr>
<td>Intermacs 3</td>
<td>26%</td>
<td></td>
<td>Stable but inotropic therapy-dependent, in hosp or home</td>
<td>+ Arr, + Frequent Flyer</td>
</tr>
<tr>
<td>Intermacs 4</td>
<td>13%</td>
<td></td>
<td>Resting symptoms on oral therapy at home.</td>
<td>+ Arr, + FF</td>
</tr>
<tr>
<td>Intermacs 5</td>
<td>3%</td>
<td></td>
<td>“Housebound”, Comfortable at rest, symptoms with minimal daily activity</td>
<td>+ Arr, + FF</td>
</tr>
<tr>
<td>Intermacs 6</td>
<td>2%</td>
<td></td>
<td>“Walking wounded” - ADL possible but meaningful activity limited</td>
<td>+ Arr, + FF</td>
</tr>
<tr>
<td>Intermacs 7</td>
<td>1%</td>
<td></td>
<td>Advanced Class III</td>
<td>+ Arr</td>
</tr>
</tbody>
</table>

#### Clinical Decisions For Support

- **Device Or Death**
- **Beyond survival:** function, quality outcomes for individualized decisions
THE PATIENTS EXPERIENCE
TIME TO REFER

Advancing the way heart failure is treated
MCS/VAD team

- Cardio thoracic surgeons
- Advanced Heart Failure/HTx cardiologists
- MCS coördinators
  - IC nurses
  - Technicians
- Fysical therapists
- Dieticians
- Social Workers
- Secretarial support
Complications of MCS therapy

- Medical complications
- Technical complications
VAD-Related Complications

Hate IRS

H - Hemorrhage
A - Aortic Insufficiency
T - Thrombosis
E - Embolism
I - Infection
R - Right ventricular dysfunction
S - Stroke
BLEEDING & THROMBOTIC EVENTS

- Thrombus
  - De novo
  - ingested

- Bleeding

- Stroke
Tasks of the MCS team

- Coordination of total medical care of MCS-patients (GP role)
- First contact for all patients
- Responsible for clinical care and out-patient care
- Out-patient care by cardiologists and MCS-nurses/technicians, every 3 months, or more.
- Training on wound/driveline care
- Liaison to other specialists, GP, ambulance
- Coordination of anticoagulation
- Education of hospital employees
- Coordination of technical maintenance of the device
- Inform GP and ambulance service at discharge
24/7 availability of the team mandatory
Your plan

Reality
Advanced Heart Failure

when the going gets tough, the tough get going