PLACE | ACADEMY

I Seminari di PLACE Academy 2023
Corsi ECM residenziali

Direzione scientifica
Leonardo Calò - Marco Rebecchi
Policlinico Casilino - Roma

I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

Dott.ssa Marina Comisso
Cardiochirurgia e trapianto di Cuore
Ospedale San Camillo-Forlanini
Roma

Scompenso cardiaco avanzato

Trapianto di Cuore: gold standard per il trattamento dello scompenso cardiaco avanzato che non risponde a terapia convenzionale.

Pazienti già in trattamento ottimale con terapie convenzionali per l'insufficienza cardiaca

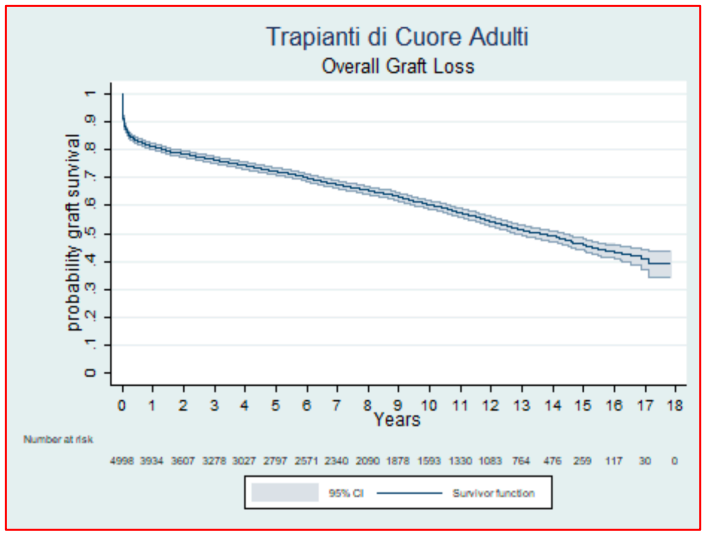
(Terapia medica ottimale, ICD, CRT, chirurgia convenzionale)

Rete Nazionale Trapianti

Centro Nazionale Trapianti

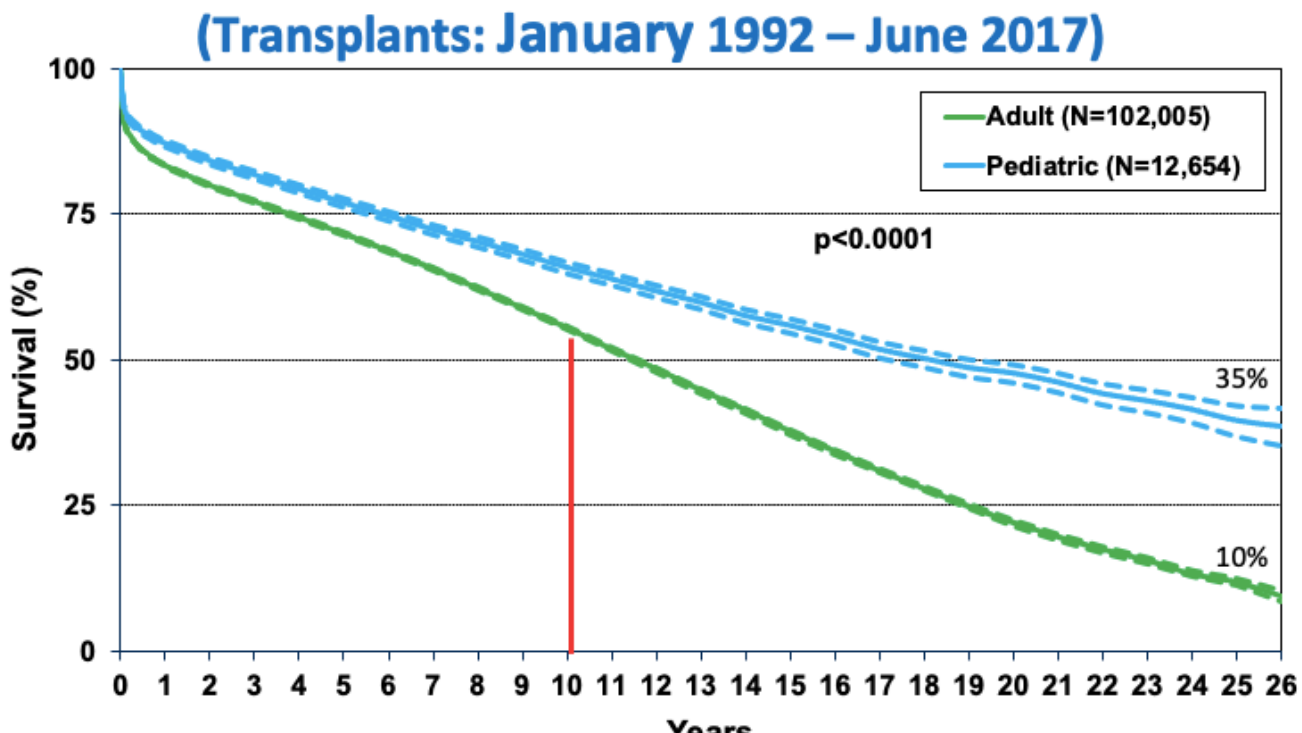
Sopravvivenza Trapianto di Cuore in Italia

Casistica Adulti 2000-18											
1 mese		3 mesi		6 mesi		3 anni		5 anni		10 anni	
Paziente	Organo	Paziente	Organo	Paziente	Organo	Paziente	Organo	Paziente	Organo	Paziente	Organo
89,4%	88,8%	85,4%	84,9%	83,6%	83,1%	76,9%	76,3%	72,9%	72,2%	61,1%	60,3%
[88,5% - 90,2%]	[87,9% - 89,6%]	[84,4% - 86,3%]	[83,9% - 85,9%]	[82,5% - 84,6%]	[82,1% - 84,1%]	[75,7% - 78%]	[75% - 77,4%]	[71,6% - 74,2%]	[70,9% - 73,5%]	[59,5% - 62,6%]	[58,7% - 61,8%]



5 anni		10 anni	
Paziente	Organo	Paziente	Organo
72,9%	72,2%	61,1%	60,3%
[71,6% - 74,2%]	[70,9% - 73,5%]	[59,5% - 62,6%]	[58,7% - 61,8%]

Sopravvivenza Trapianto di Cuore età Pediatrica e Adulti *(ISHLT)*

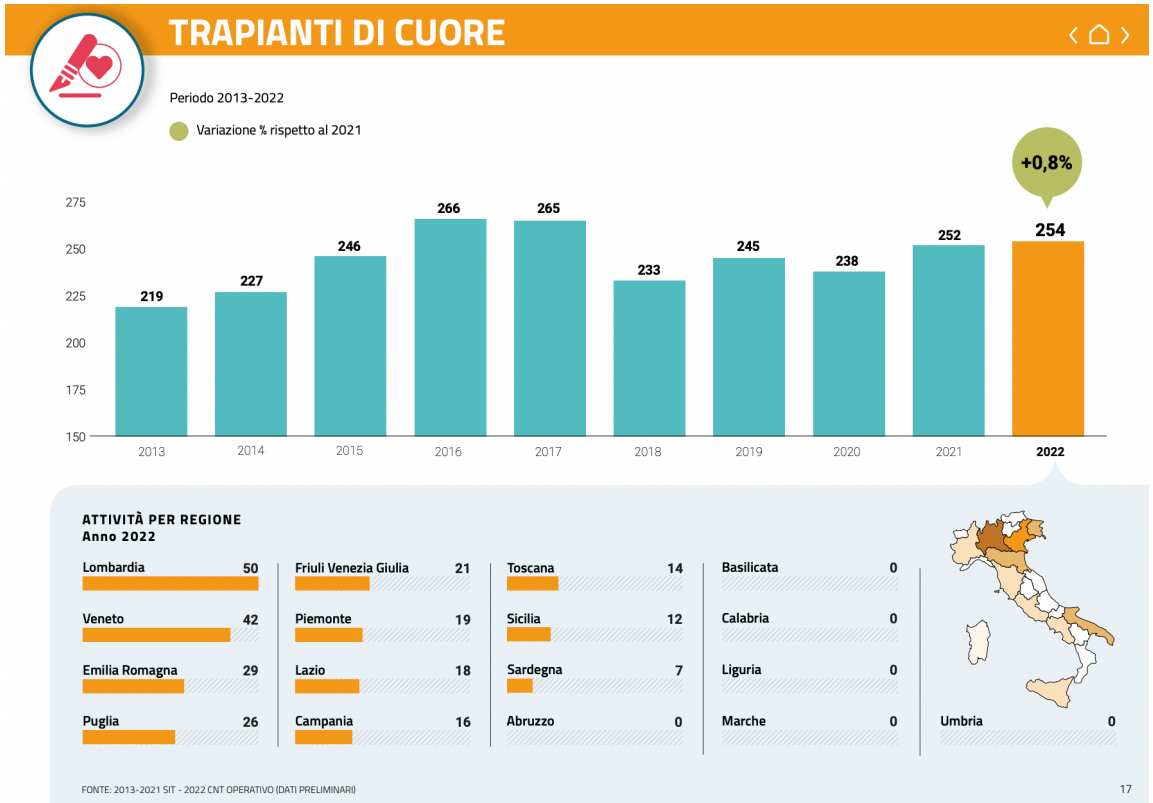


ISHLT 2019
ISHLT • INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION

Trapianto Cardiaco in Italia

Rete Nazionale Trapianti

Centro Nazionale Trapianti



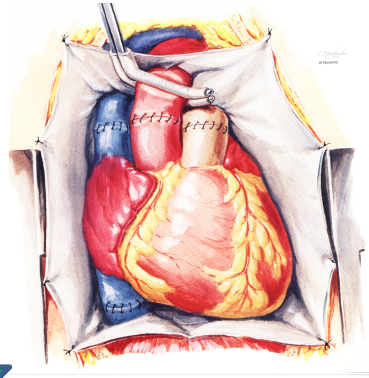
Lista per trapianto di cuore in Italia

Al 31 dicembre 2021, **1041 iscrizioni**; il tasso di **mortalità** in lista è pari al **6,9%** mentre l'indice di **soddisfacimento di lista totale è di 24,2%**

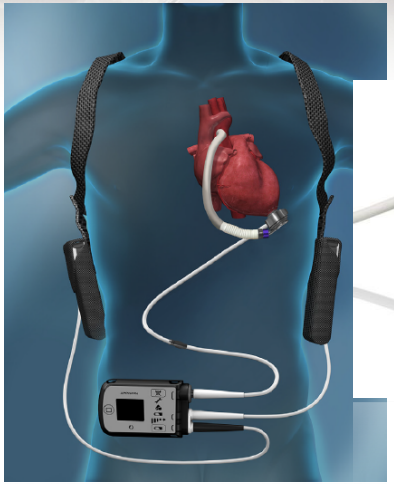
Rete Nazionale Trapianti

Centro Nazionale Trapianti

Opzioni chirurgiche per l'insufficienza cardiaca avanzata



***Trapianto Cardiaco* "gold standard"** ma severamente limitato dalla carenza di donatori



Assistenza Ventricolare Meccanica
Come Ponte al Trapianto o Terapia Permanente

2019 EACTS Expert Consensus on long-term mechanical circulatory support

Evgenij V. Potapov[a,*,†] (EACTS Chairperson), Christiaan Antonides[b,†], Maria G. Crespo-Leiro[c], Alain Combes[d,e], Gloria Färber[f], Margaret M. Hannan[g], Marian Kukucka[h], Nicolaas de Jonge[i], Antonio Loforte[j], Lars H. Lund[k], Paul Mohacsi[l], Michiel Morshuis[m], Ivan Netuka[n], Mustafa Özbaran[o], Federico Pappalardo[p], Anna Mara Scandroglio[q], Martin Schweiger[r], Steven Tsui[s], Daniel Zimpfer[t] and Finn Gustafsson[u,*] (EACTS Chairperson), The Task Force on Long-Term Mechanical Circulatory Support of the EACTS

Recommendations for evaluation and selection of patients for LT-MCS therapy

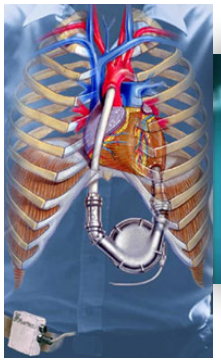
Recommendation	Class	Level	References
It is recommended that reversible causes of heart failure are ruled out.	I	B	
LT-MCS implantation should be considered in patients with the following: • New York Heart Association functional class IIIB–IV and • Ejection fraction ≤25% and At least one of the following criteria: ○ INTERMACS 2–4 ○ Inotrope dependence ○ Progressive end-organ dysfunction ○ Peak VO_2 <12 ml/kg/min ○ Temporary MCS dependence	IIa	B	
LT-MCS implantation may be considered in patients with: • New York Heart Association functional class IIIB–IV and • Ejection fraction ≤25% and ○ To reverse elevated pulmonary vascular resistance or potentially reversible renal failure in potential heart transplant candidates ○ To allow time for transplant contraindications to be reversed such as recent cancer, obesity and recovering drug and alcohol dependence in potential heart transplant candidates	IIb	B	

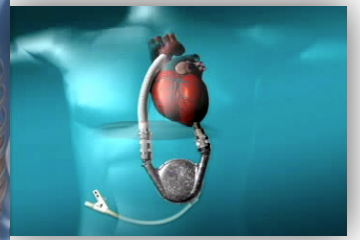
LVAD evolution

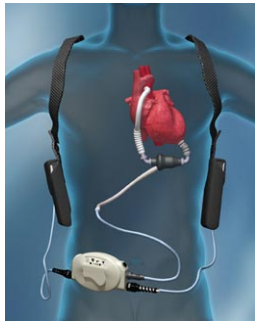
1° generation "volume displacement pump"

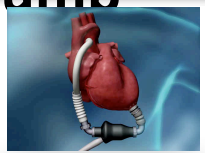
2° generation "continous flow rotary pump"

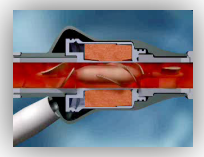
3° generation "FullMagnetic levitation"

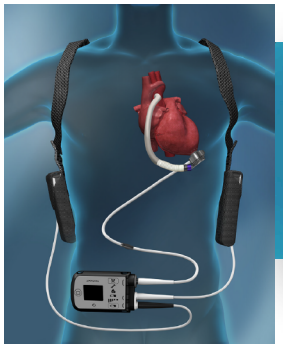


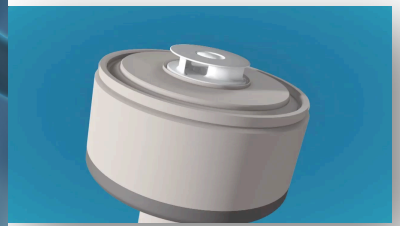






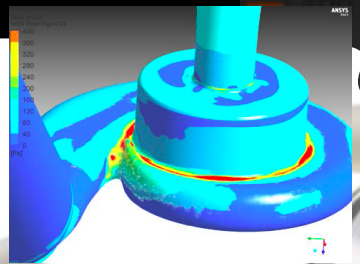


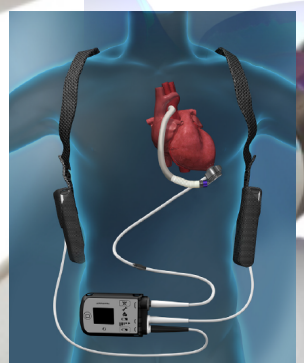


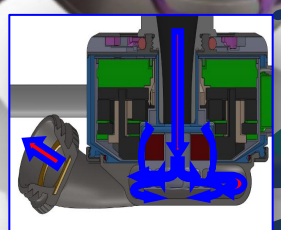


HeartMate III **LVAD**

Full MagLev Technology







- Continous-flow rotary technology
- Centrifugal configuration
- Non contact bearing design
- Development of pulsatile flow
- Better “washing” of the impeller with reduced risk of thrombus formation.
- Better surface biocompatibility

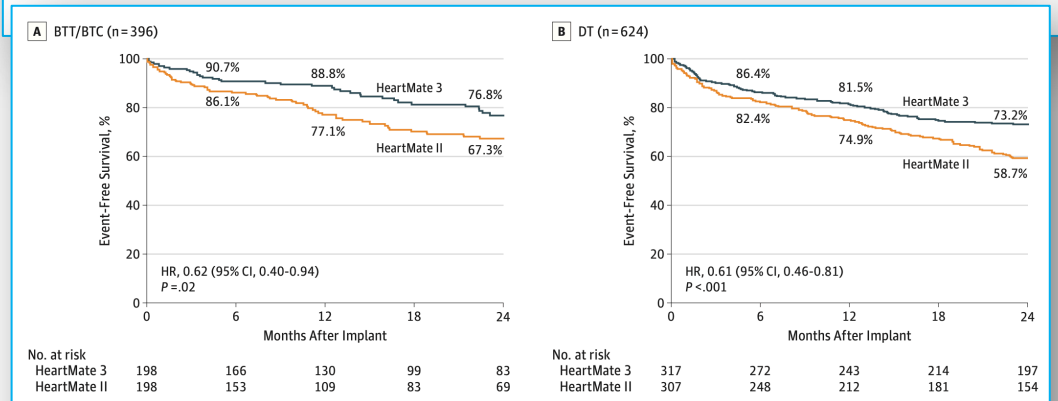
I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

JAMA Cardiology | Original Investigation

Association of Clinical Outcomes With Left Ventricular Assist Device Use by Bridge to Transplant or Destination Therapy Intent

The Multicenter Study of MagLev Technology in Patients Undergoing Mechanical Circulatory Support Therapy With HeartMate 3 (MOMENTUM 3) Randomized Clinical Trial

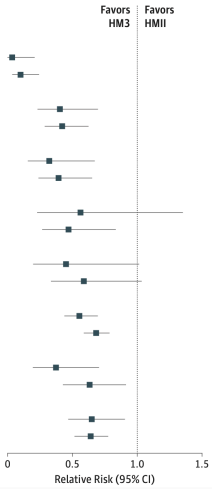
Daniel J. Goldstein, MD; Yoshifumi Naka, MD, PhD; Douglas Horstmanshof, MD; Ashwin K. Ravichandran, MD, MPH; Jacob Schroder, MD; John Ransom, MD; Akinobu Itoh, MD; Nir Uriel, MD; Joseph C. Cleveland Jr, MD; Nirav Y. Rebecca Cogswell, MD; Erik E. Suarez, MD; Brian D. Lowes, MD, PhD; Gene Kim, MD; Pramod Bonde, MD; Farooq H. Sheikh, MD; Poornima Sood, MD; David J. Farrar, PhD; Mandeep R. Mehra, MD, MSc



Survival at 2 years free of disabling stroke (defined as a modified Rankin score greater than 3) or reoperation to replace or remove a malfunctioning device in the bridge to transplant (BTT)/bridge to transplant candidacy (BTC) and destination therapy (DT) cohorts. HR indicates hazard ratio.

Figure 3. Comparison of Hemocompatibility-Associated Adverse Events With HeartMate 3 vs HeartMate II Devices in the Bridge to Transplant (BTT)/Bridge to Transplant Candidacy (BTC) and Destination Therapy (DT) Cohorts

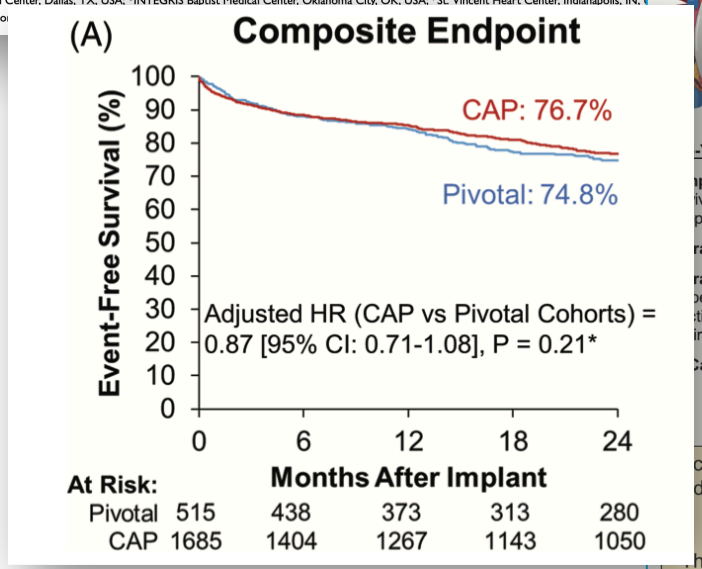
Adverse Event	No. of Patients With Events (%) HM3	No. of Patients With Events (%) HMII	No. of Events per Patient-Year HM3	No. of Events per Patient-Year HMII	Relative Risk (95% CI)	Interaction P Value
Suspected or confirmed pump thrombosis						
BTT/BTC	1 (0.5)	27 (13.6)	0.00	0.13	0.03 (0.00-0.21)	.20
DT	6 (1.9)	43 (14.0)	0.01	0.12	0.10 (0.04-0.24)	
Any stroke						
BTT/BTC	17 (8.6)	33 (16.7)	0.07	0.17	0.40 (0.23-0.69)	.86
DT	34 (10.7)	65 (21.2)	0.08	0.19	0.42 (0.29-0.62)	
Ischemic stroke						
BTT/BTC	10 (5.1)	24 (12.1)	0.04	0.11	0.32 (0.16-0.67)	.66
DT	19 (6.0)	41 (13.4)	0.04	0.11	0.39 (0.24-0.65)	
Hemorrhagic stroke						
BTT/BTC	8 (4.0)	12 (6.1)	0.03	0.05	0.56 (0.23-1.35)	.74
DT	17 (5.4)	31 (10.1)	0.04	0.08	0.47 (0.27-0.83)	
Disabling stroke						
BTT/BTC	8 (4.0)	14 (7.1)	0.03	0.07	0.45 (0.20-1.01)	.60
DT	18 (5.7)	24 (7.8)	0.04	0.07	0.59 (0.34-1.03)	
Bleeding						
BTT/BTC	69 (34.8)	96 (48.5)	0.44	0.80	0.55 (0.44-0.69)	.11
DT	156 (49.2)	182 (59.3)	0.70	1.03	0.68 (0.59-0.78)	
Bleeding requiring surgery						
BTT/BTC	14 (7.1)	28 (14.1)	0.05	0.14	0.37 (0.20-0.70)	.16
DT	36 (11.4)	61 (19.9)	0.09	0.15	0.63 (0.43-0.91)	
Gastrointestinal bleeding						
BTT/BTC	35 (17.7)	42 (21.2)	0.24	0.36	0.65 (0.47-0.90)	.89
DT	91 (28.7)	114 (37.1)	0.36	0.56	0.64 (0.52-0.77)	



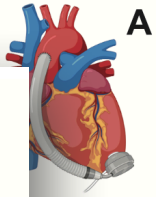
Primary results of long-term outcomes in the MOMENTUM 3 pivotal trial and continued access protocol study phase: a study of 2200 HeartMate 3 left ventricular assist device implants

Mandeep R. Mehra[1]*, Joseph C. Cleveland Jr[2], Nir Uriel[3], Jennifer A. Cowger[4], Shelley Hall[5], Douglas Horstmanshof[6], Yoshifumi Naka[3], Christopher T. Salerno[7], Joyce Chuang[8], Christopher Williams[8], and Daniel J. Goldstein[9], on behalf of the MOMENTUM 3 Investigators

[1]Brigham and Women's Hospital Heart and Vascular Center and Harvard Medical School, Boston, MA, USA; [2]University of Colorado School
[3]Columbia University College of Physicians and Surgeons and New York-Presbyterian Hospital, New York, NY, USA; [4]Henry Ford Hospitals,
Medical Center, Dallas, TX, USA; [6]INTEGRIS Baptist Medical Center, Oklahoma City, OK, USA; [7]St. Vincent Heart Center, Indianapolis, IN,
and [9]Mo



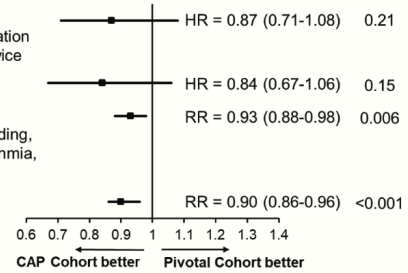
European Journal of Heart Failure 2021



A Study of 2200 HeartMate 3 Left Ventricular Assist Device Implants in the MOMENTUM 3 Trial Portfolio

Are long-term outcomes with the HM3 LVAD in the post-pivotal trial experience different from early pivotal-trial observations?

Principal Outcomes



- 2200 HM3 implanted patients - 515 pivotal trial and 1685 continuous access protocol (CAP) patients
- Similar 2-year survival between CAP and pivotal trial cohorts (81.2% vs 79.0%) despite sicker patients (more intra-aortic balloon pump use and INTERMACS 1 profile) and more transplant ineligible patients intended for destination therapy in CAP
- Similar 2-year survival between CAP and pivotal trial cohorts in transplant ineligible patients (79.1% vs 76.7%) even after adjusting for baseline differences (HR=0.89 [95% CI: 0.68-1.16], P=0.38)

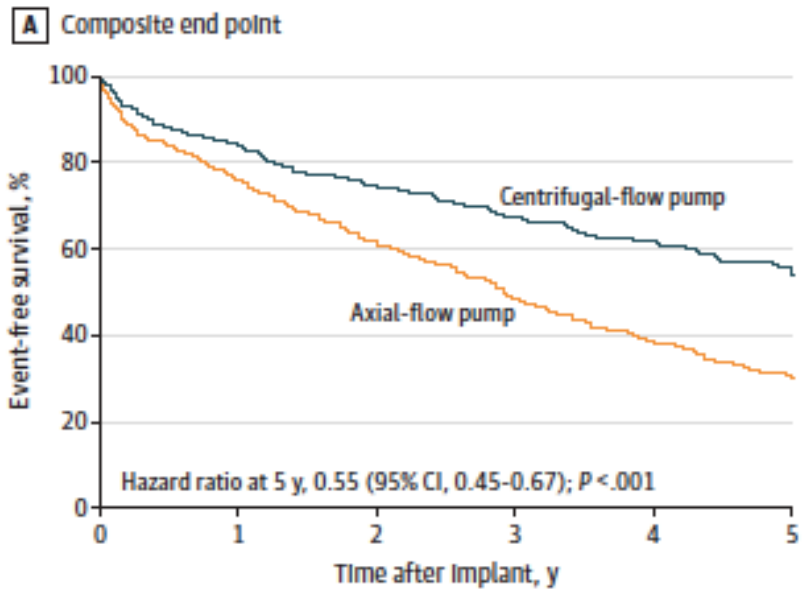
ccumulating post-pivotal trial experience with the HM3 LVAD suggests a lower adverse event burden, reduced hospitalizations d similar survival free of disabling stroke or reoperation to replace or remove a malfunctioning pump as compared to the pivotal MOMENTUM 3 trial outcomes at 2 years

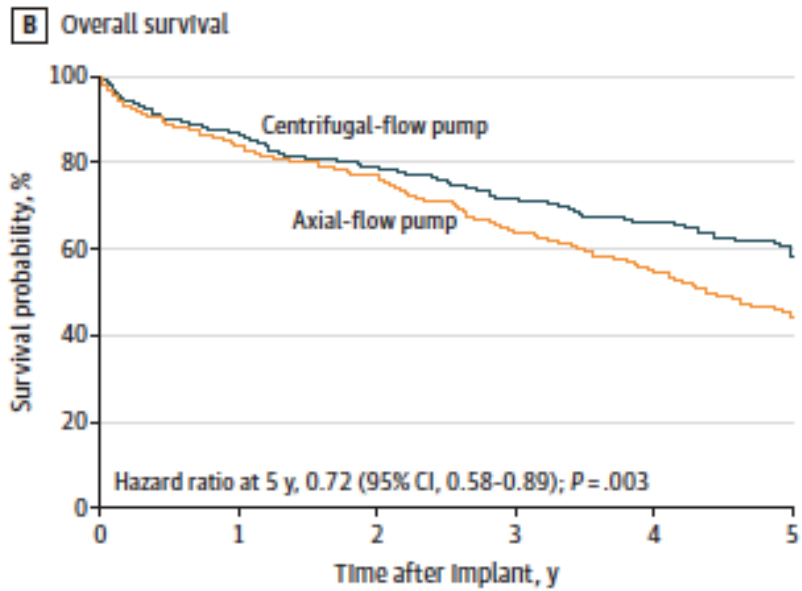
hese beneficial outcomes were noted across the continuum of clinical severity in advanced heart failure and especially among transplant ineligible patients in whom outcomes may now compare favorably with those in transplant eligible patients at 2 years

JAMA | Original Investigation

Five-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices in the MOMENTUM 3

Figure 2. Composite End Point and Overall Survival in a Study of 5-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices (LVADs)





No. of patients

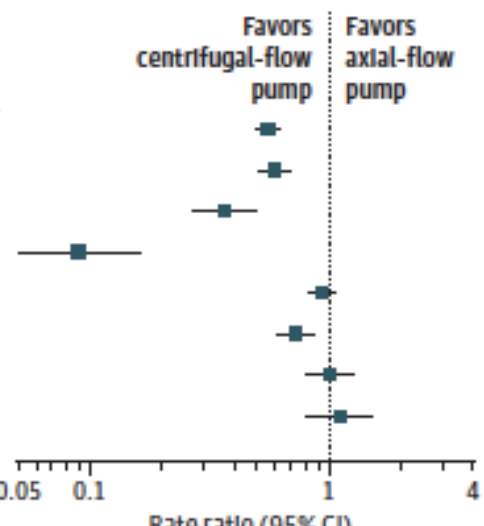
Centrifugal-flow pump	515	373	280	208	177	138	515	383	289	213	184	141
Axial-flow pump	505	321	223	147	106	71	505	339	247	165	124	85

JAMA | Original Investigation

Five-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices in the MOMENTUM 3 Randomized Trial

Figure 3. Serious Adverse Events in a Study of 5-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices

Serious adverse event	Events/patient-years: Centrifugal-flow pump (515 patients; 1234 patient-years)	Events/patient-years: Axial-flow pump (505 patients; 997 patient-years)	Rate ratio (95% CI)	P value[a]
Any bleeding	0.430	0.765	0.56 (0.50-0.63)	<.001
Gastrointestinal bleeding	0.252	0.423	0.60 (0.51-0.69)	<.001
Any stroke	0.050	0.136	0.37 (0.27-0.50)	<.001
Suspected or confirmed pump thrombosis	0.010	0.108	0.09 (0.05-0.16)	<.001
Any major infection	0.515	0.551	0.94 (0.83-1.05)	.25
Cardiac arrhythmia	0.207	0.283	0.73 (0.62-0.87)	<.001
Right heart failure	0.149	0.146	1.02 (0.82-1.27)	.87
Other neurologic event[b]	0.073	0.065	1.12 (0.81-1.54)	.49



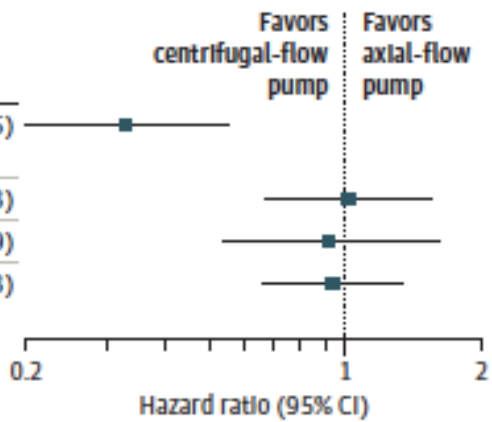
JAMA | Original Investigation

Five-Year Outcomes in Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices in the MOMENTUM 3 Randomized Trial

Mandeep R. Mehra, MD, MSc; Daniel J. Goldstein, MD; Joseph C. Cleveland, MD; Jennifer A. Cowger, MD, MS; Shelley Hall, MD; Christopher T. Salerno, MD; Yoshifumi Naka, MD, PhD; Douglas Horstmanshof, MD; Joyce Chuang, PhD; AiJia Wang, MPH; Nir Uriel, MD, MSc

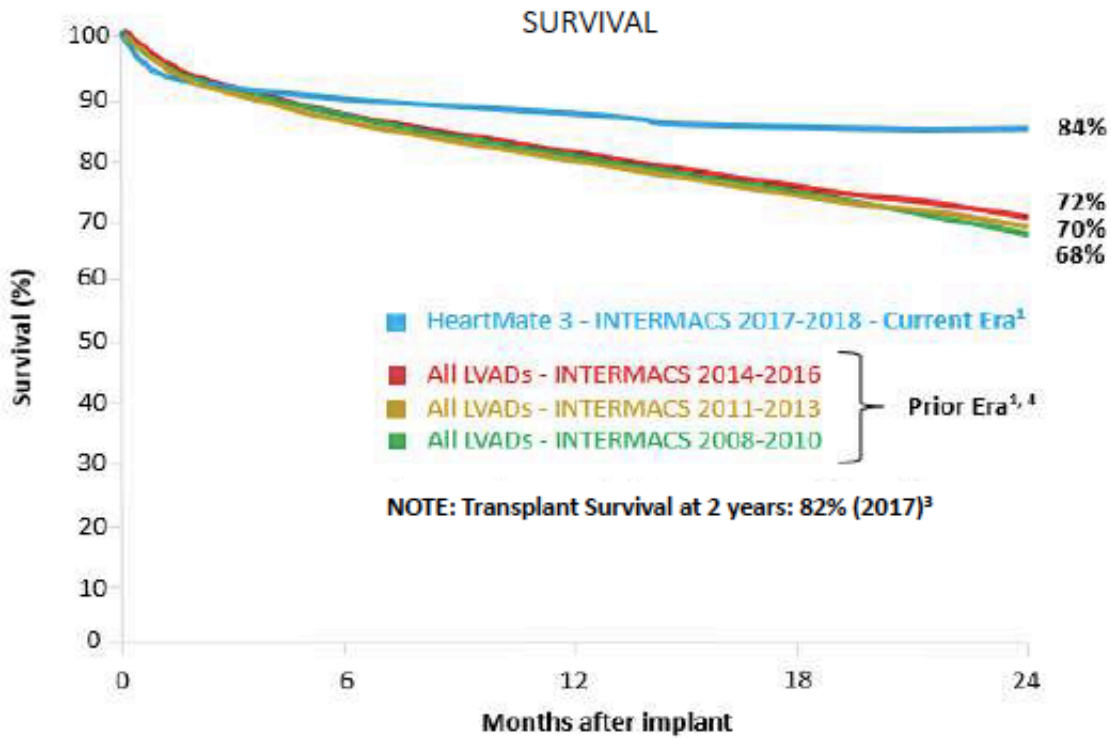
Figure 4. Cause-Specific Mortality 5 Years After Implant in a Study of Patients With Fully Magnetically Levitated vs Axial-Flow Left Ventricular Assist Devices

Cause of death	No. (%) Centrifugal-flow pump (n = 515)	No. (%) Axial-flow pump (n = 505)	Difference, % (95% CI) %[a]	Hazard ratio (95% CI)	*P* value[b]
Hemocompatibility-related event (device thrombosis, stroke, bleeding)	20 (3.9)	54 (10.7)	-6.8 (-10.0 to -3.6)	0.33 (0.20-0.55)	<.001
Heart failure	47 (9.1)	43 (8.5)	0.6 (-2.9 to 4.1)	1.01 (0.67-1.53)	.95
Infection	26 (5.0)	26 (5.1)	-0.1 (-2.8 to 2.6)	0.92 (0.54-1.59)	.77
Other[c]	63 (12.2)	61 (12.1)	0.0 (-4.1 to 4.0)	0.94 (0.66-1.33)	.72



LVAD Survival Across Intermacs‡ Database Eras[1]

REAL-WORLD OUTCOMES FOR THE HEARTMATE 3™ LVAD ARE CONSISTENT WITH MOMENTUM 3 OUTCOMES[2]



Data presented for informational purposes only.

1. Adapted from Teuteberg, et al. *Ann Thorac Surg*. 2020;109:649-60.
2. Mehra, et al. *N Engl J Med*. 2019;380:1618-1627.
3. Khush, et al. The International Thoracic Organ Transplant Registry of the International Society for Heart and Lung Transplantation: Thirty-fifth Adult Heart Transplant Report. 2018.
4. Kirklin, et al. *J Heart Lung Transplant*. 2014;33:555-564.

Long-term mechanical circulatory support (destination therapy): On track to compete with heart transplantation?

James K. Kirklin, MD,[a] David C. Naftel, PhD,[a] Francis D. Pagani, MD, PhD,[b] Robert L. Kormos, MD,[c] Lynne Stevenson, MD,[d] Marissa Miller, DVM, MPH,[e] and James B. Young, MD[f]

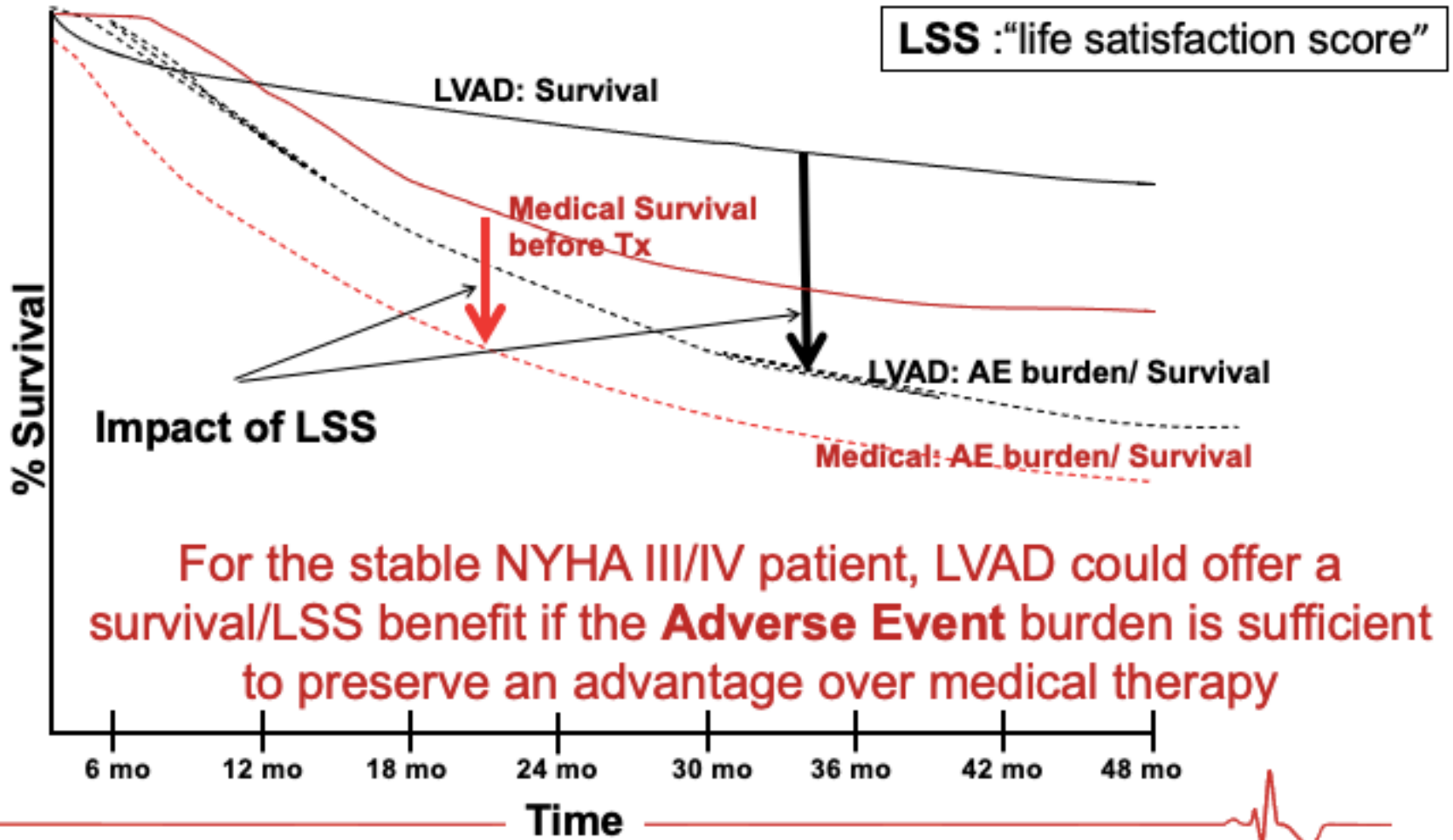
Objectives: Average 2-year survival after cardiac transplantation is approximately 80%. The evolution and subsequent approval of larger pulsatile and, more recently, continuous flow mechanical circulatory support (MCS) technology for destination therapy (DT) offers the potential for triage of some patients awaiting cardiac transplantation to DT.

Methods: The National Heart, Lung, and Blood Institute Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) is a national multi-institutional study of long-term MCS. Between June 2006 and December 2011, 127 pulsatile and 1160 continuous flow pumps (24% of total primary left ventricular assist devices [LVADs]) carried an initial strategy of DT therapy.

Results: By multivariable analysis, risk factors ($P < .05$) for mortality after DT included older age, larger body mass index, history of cancer, history of cardiac surgery, INTERMACS level I (cardiogenic shock), dialysis, increased blood urea nitrogen, use of a pulsatile flow device, and use of a right ventricular assist device (RVAD). Among patients with a continuous flow LVAD who were not in cardiogenic shock, a particularly favorable survival was associated with no cancer, patients not in cardiogenic shock, and blood urea nitrogen less than 50 mg/dL, resulting in 1- and 2-year survivals of 88% and 80%.

Conclusions: (1) Evolution from pulsatile to continuous flow technology has dramatically improved 1- and 2-year survivals; (2) DT is not appropriate for patients with rapid hemodynamic deterioration or severe right ventricular failure; (3) important subsets of patients with continuous flow DT now enjoy survival that is competitive with heart transplantation out to about 2 years. (J Thorac Cardiovasc Surg 2012;144:584-603)

The Future of VAD vs Medical Therapy

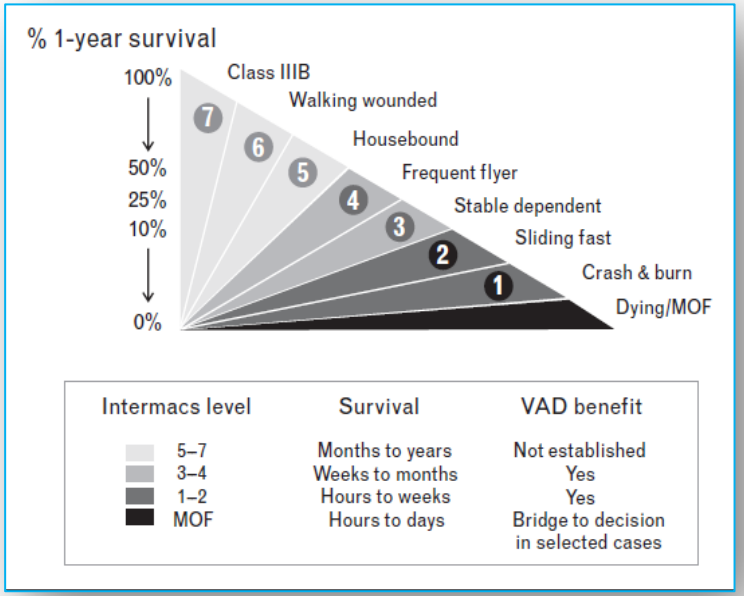


For the stable NYHA III/IV patient, LVAD could offer a survival/LSS benefit if the **Adverse Event** burden is sufficient to preserve an advantage over medical therapy

Patient Profile/ Status: INTERMACS Levels

1. Critical cardiogenic shock
2. Progressive decline
3. Stable but inotrope dependent
4. Recurrent advanced HF
5. Exertion intolerant
6. Exertion limited
7. Advanced NYHA III

INDICATIONS for Transplant/ VAD



AMBULATORY HEART FAILURE PATIENTS

I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

Evaluation for Heart Transplantation and LVAD Implantation

JACC Council Perspectives

Maya Guglin, M
Maryl R. Johnsc
Biykem Bozkurt
and Leadership

ABSTRACT

Timely referrals
patients with a
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2) Are there co
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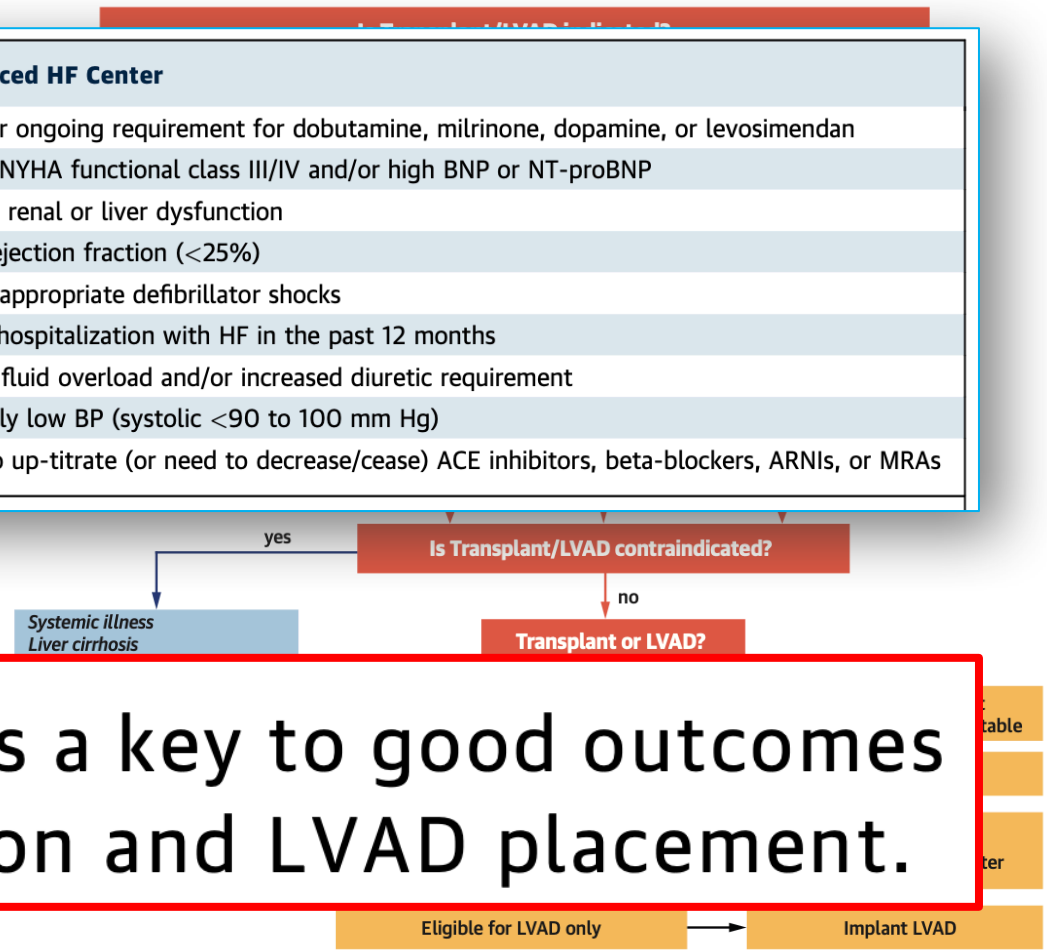
TABLE 2 Simplified Signs Prompting Referrals to Advanced HF Center

I	Inotropes	Previous or ongoing requirement for dobutamine, milrinone, dopamine, or levosimendan
N	NYHA class/natriuretic peptides	Persisting NYHA functional class III/IV and/or high BNP or NT-proBNP
E	End-organ dysfunction	Worsening renal or liver dysfunction
E	Ejection fraction	Very low ejection fraction (<25%)
D	Defibrillator shocks	Recurrent appropriate defibrillator shocks
H	Hospitalizations	At least 1 hospitalization with HF in the past 12 months
E	Edema/escalating diuretic agents	Persistent fluid overload and/or increased diuretic requirement
L	Low BP	Consistently low BP (systolic <90 to 100 mm Hg)
P	Prognostic medications	Inability to up-titrate (or need to decrease/cease) ACE inhibitors, beta-blockers, ARNIs, or MRAs

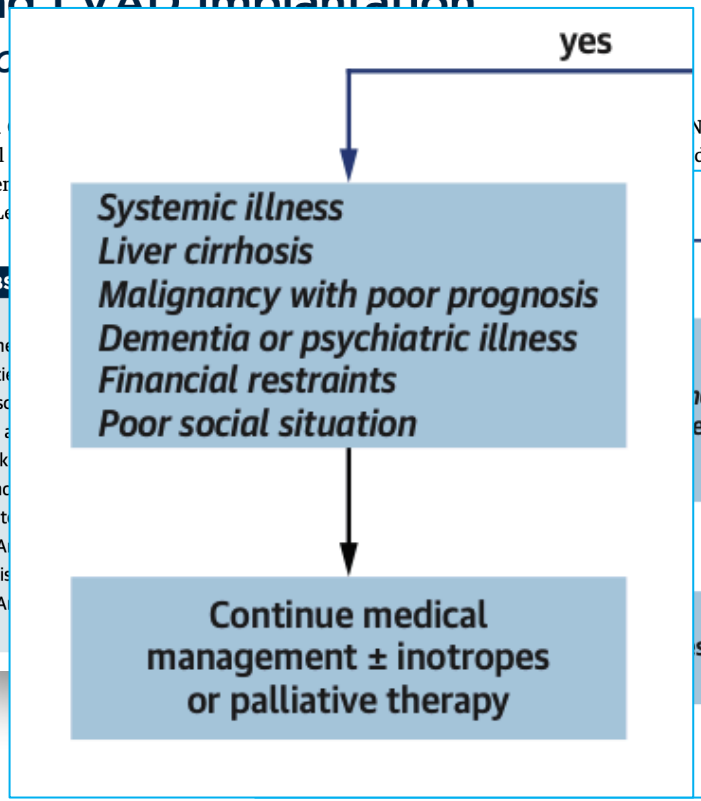
CENTRAL ILLUSTRATION Advanced Heart Failure Center: Decision Making

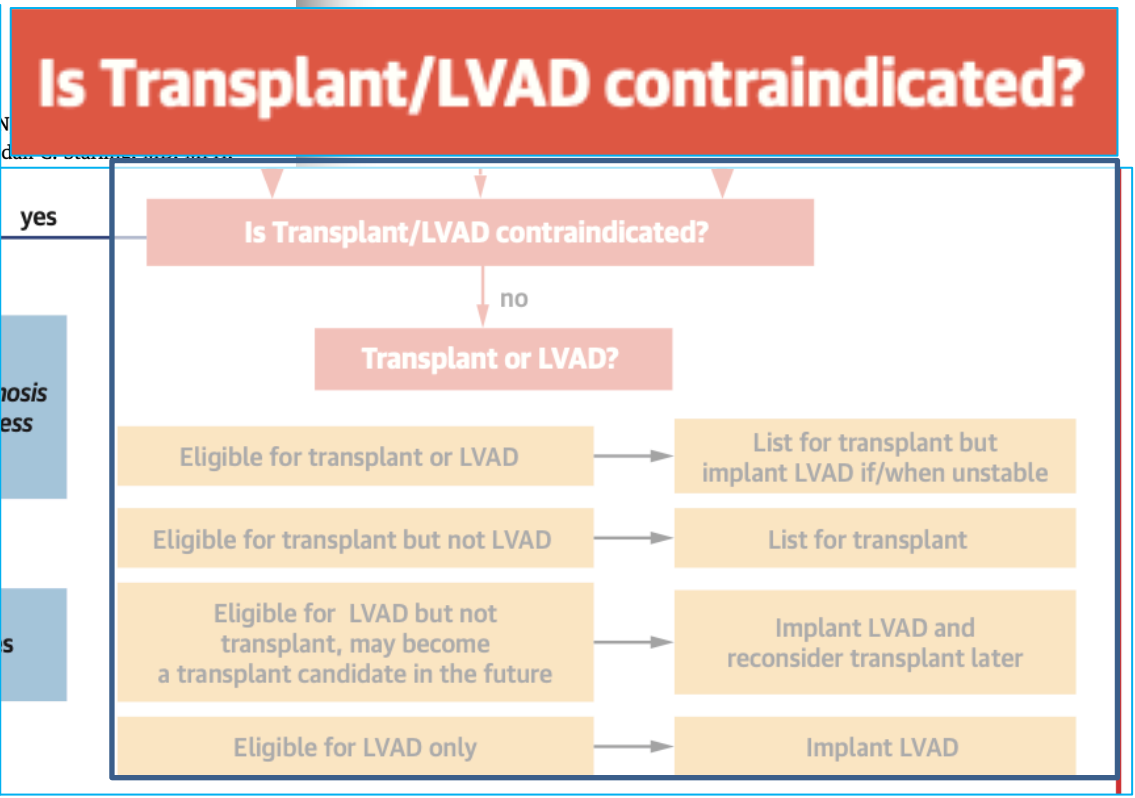


- Timely referral is a key to good outcomes of transplantation and LVAD placement.

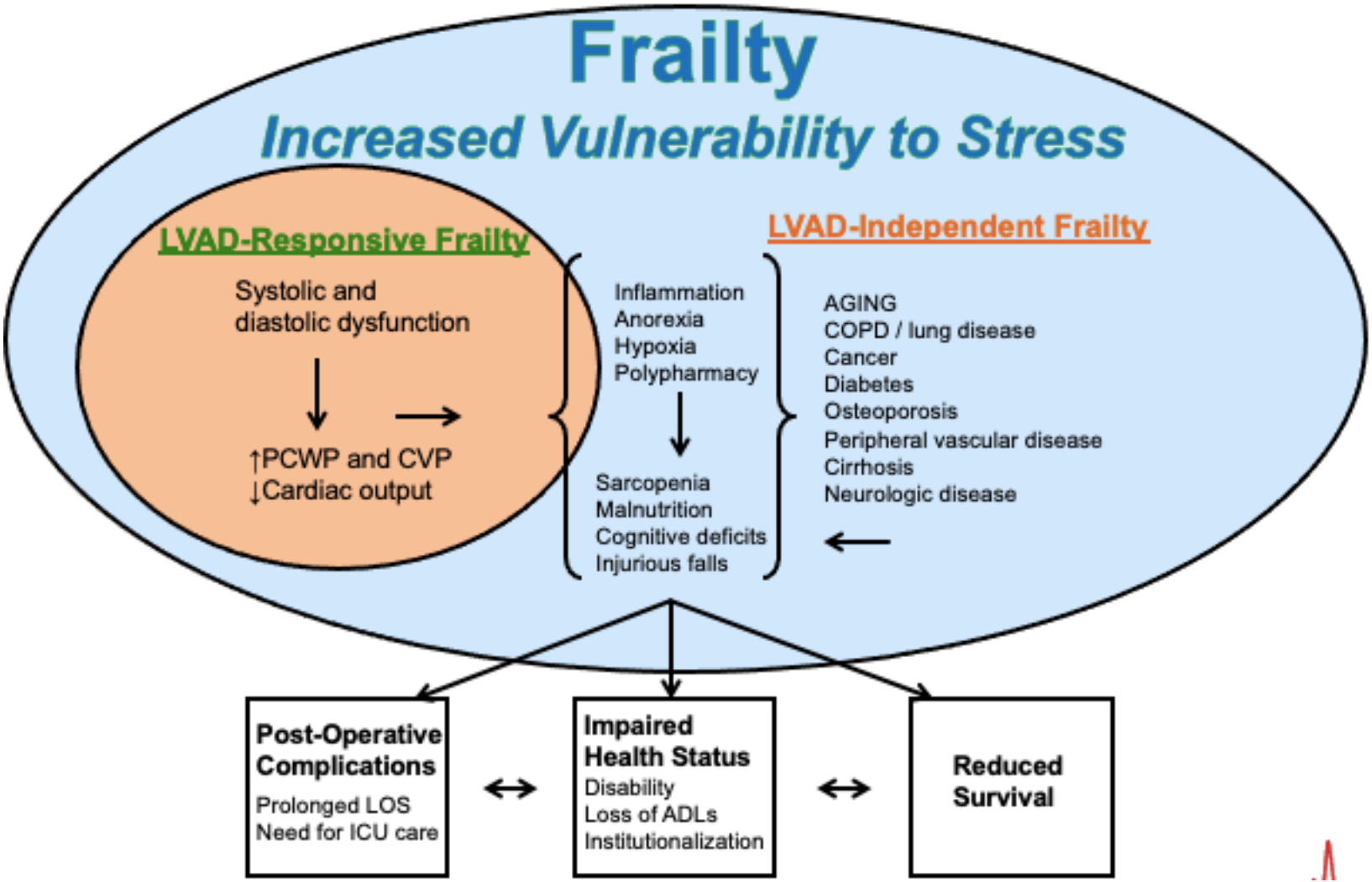
I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

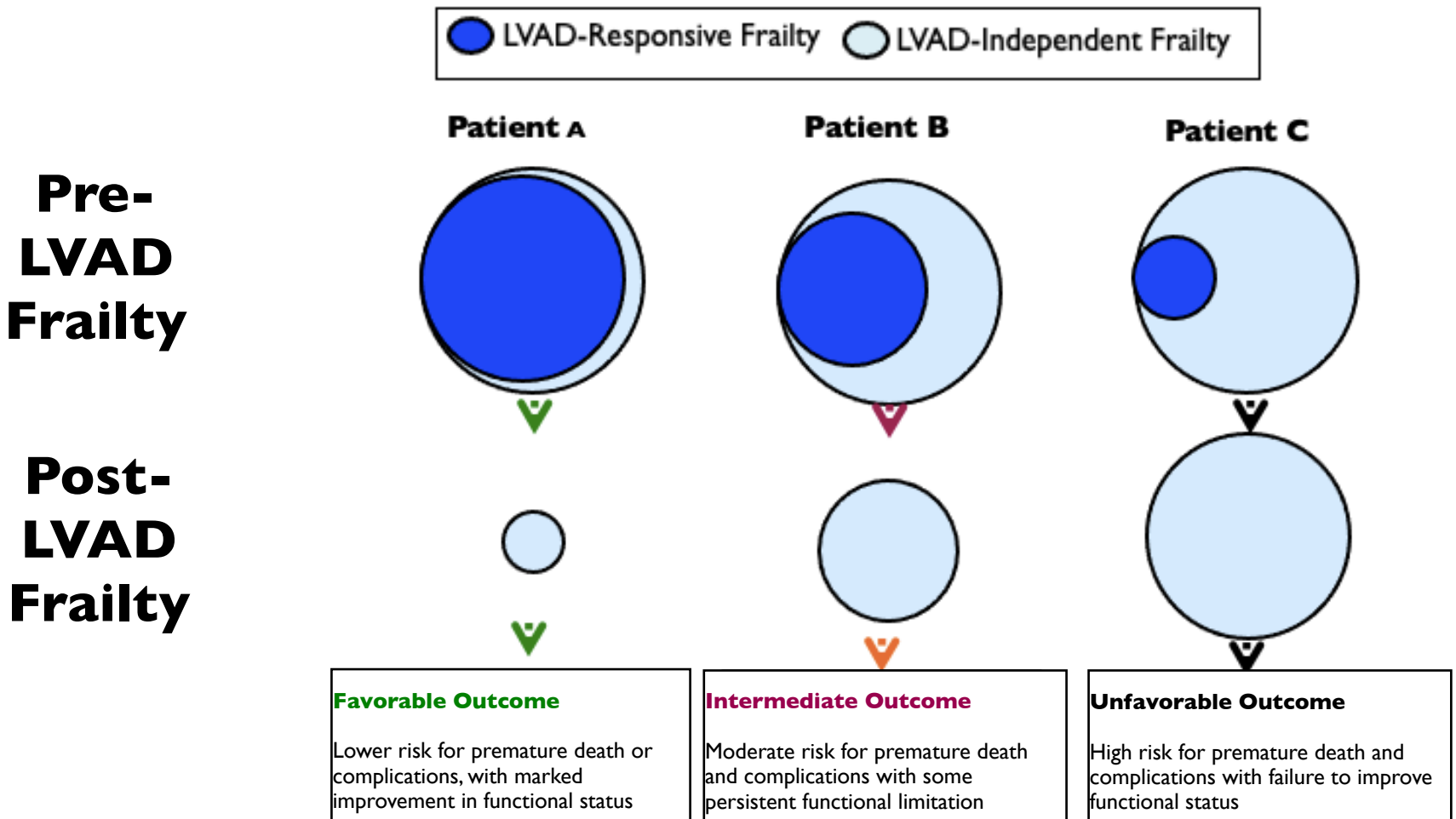
Evaluation for Heart Transplantation and LVAD Implantation





I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa




LVAD-Responsive Frailty
LVAD-Independent Frailty
Patient A
Patient B
Patient C
Pre-LVAD Frailty
Post-LVAD Frailty
Favorable Outcome
Lower risk for premature death or complications, with marked improvement in functional status
Intermediate Outcome
Moderate risk for premature death and complications with some persistent functional limitation
Unfavorable Outcome
High risk for premature death and complications with failure to improve functional status

4 percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

Maria G. (
icolaas de
Martin

Recommendation	Class	Level	References
Renal function			
In patients with renal dysfunction, optimization via improvement of cardiac output and reduction of filling pressures is recommended.	I	B	[56]
Liver function			
Liver function evaluation with bilirubin is recommended.	I	B	[57, 58]
In patients with increasingly elevated bilirubin levels, temporary MCS, ahead of possible LT-MCS implantation, may be considered.	IIb	B	[59]
Pulmonary function			
Treatment of preimplant pulmonary oedema is recommended before implantation.	I	B	[60, 61]
Left ventricular unloading on extracorporeal life support to optimize lung function should be considered.	IIa	B	[62]
Respiratory physiotherapy should be considered.	IIa	C	
Coagulation			
Withdrawal of dual antiplatelet therapy and/or vitamin K antagonists to reduce the risk of bleeding is recommended.	I	B	[63, 64]
The use of short-acting intravenous anticoagulation as bridging is recommended.	I	B	[64]
Administration of procoagulants shortly before implantation of the LT-MCS may be considered.	IIb	B	[64]
Optimization of coagulation prior to surgery should be considered, especially in patients on temporary MCS.	IIa	C	
Nutritional, metabolic and endocrine considerations			
Preoperative assessment of metabolic, endocrine and nutritional status, including possible interventions for arising issues, should be considered.	IIa	C	
Nutritional support, if necessary, may be considered.	IIb	C	[65, 66]

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2) Are there con

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Is Transplant/LVAD contraindicated?

Systemic illne
Liver cirrhosis
Malignancy w
Dementia or p
Financial rest
Poor social si

Contin
managem

Transplant or LVAD?

Eligible for transplant or LVAD	List for transplant but implant LVAD if/when unstable
Eligible for transplant but not LVAD	List for transplant
Eligible for LVAD but not transplant, may become a transplant candidate in the future	Implant LVAD and reconsider transplant later
Eligible for LVAD only	Implant LVAD

BRIDGE to TX

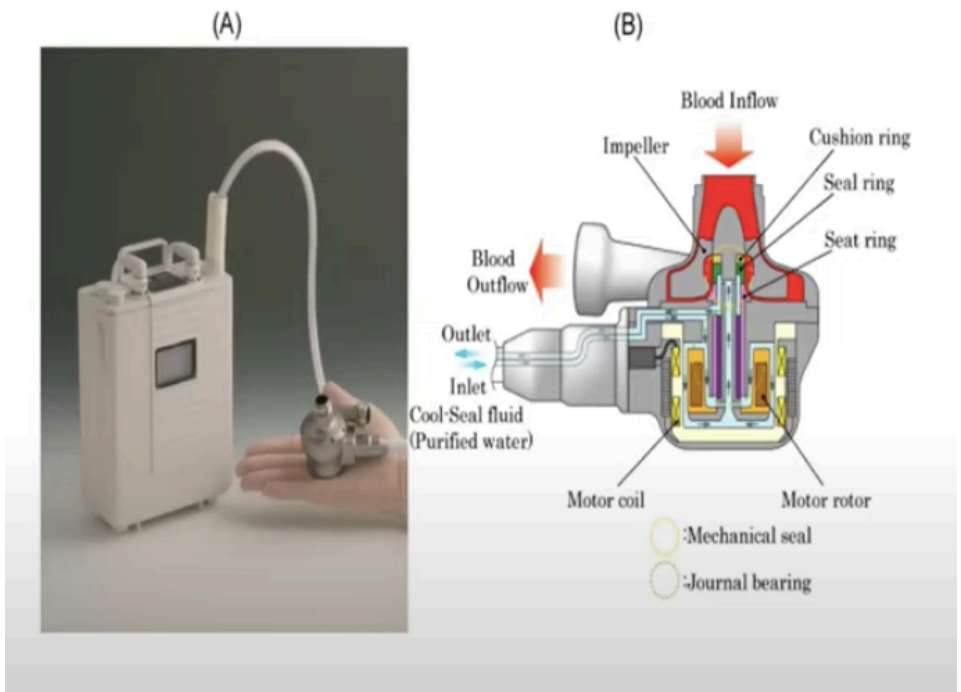
DESTINATION

Needed Advancements

- No driveline
- Wireless
- Improved hemocopatibility
- Ability to free disconnected

EvaHeart LVAD

- Hydraulically suspended impeller system promotes pulsatility
- More physiologically responsive
- COMPETENCE trial ongoing



CoreWave LVAD

- «wave membrane» technology
- Physiologic mimickig of the native heart allows for pulsatile flow
- Pre-clinical studies

When LVAD? When BiVAD/THA?

Key decision when assessing patients for VAD indication. Right ventricular failure during LVAD support is correlated with increased morbidity and mortality

Predictive index of right ventricular failure

- Ecografici:

- TAPSE < 14 mm
- RV ED S/L axis ratio > 0.57 (indice di sfericità)
- FAC < 31%
- strain della parete laterale (PSSrL < 0.6/s)
- TR > II
- RV/LV ratio > 0.75

Predictive index of right ventricular failure

- Emodinamici:
- CVP > 15 mmHg
- RAP/PCWP > 0.63
- RVSWI < 300 mmHg/ml/m2 → (MAP -RAP) x SVI= 300-900 (v.n.)
- PAPi < 1.85 → (PAS -PAD)/RAP
- CI < 2.2
- DP RV-RA < 35 mmHg

Prediction of ri ventricular assi review and me studies

Diego Bellavia[1]*, Attilio la
Michele Pilato[1], Sudhir S. I
Valentina Agnese[1], Caloge
Michael Dandel[5]

Table 4 Summary of the most relevant risk factors for right ventricular failure

Predictor	Comment
Demographic and clinical characteristics	
Age	Although several studies have reported that RVF patients are younger, according to meta-analysed data, age is a non-significant predictor of RVF.
Female gender	Females have apparently higher risk of developing post-LVAD RVF compared with males; however, this is specifically true in reports where primarily PF-LVADs are implanted.
Need for mechanical ventilation	Patients needing ventilatory support have roughly threefold increase in RVF risk, independently of type of implanted LVAD or gender. This predictor has good specificity but very low sensitivity.
Need for dialysis/CRRT	Patients needing dialysis have the highest risk of developing RVF after LVAD implantation, although this observation is based on relatively few studies ($n = 4$).
Biomarkers	
High INR	INR represents the single most significant and homogeneous biomarker in risk stratifying RVF in LVAD recipients, even a small increase should warrant attention and re-assessment.
High NT-proBNP level	Although NT-proBNP is higher in patients developing RVF, this observation is highly heterogeneous and overall marginally significant.
Haemodynamic parameters (by right heart catheterization)	
Low RVSWI	Role of RVSWI as a predictor of RVF after LVAD has been confirmed. However, its usefulness is significantly less important in the context of CF-LVADs compared with PF-LVADs.
High central venous pressure	Together with RVSWI, it is the haemodynamic predictor with the greatest effect size, specifically in patients undergoing CF-LVAD implantation
Echocardiography	
Moderate-to-severe RVD	This relatively simple, pure qualitative assessment of RV performance is extremely predictive of RVF and should be part of routine echocardiographic evaluation in patients considered for LVAD.
High RV/LV ratio	To date, the RV/LV ratio obtained in a four-chamber apical view is the single most significant quantitative echo measurement able to define risk of RVF in LVAD recipients.
Low longitudinal sS of the RV free wall	Although sS of the right ventricle is very promising, and probably useful, there is too much variability in measures and there are too few published studies to reach a definitive conclusion.

CF-LVAD, continuous-flow left ventricular assist device; CRRT, continuous renal replacement therapy; INR, international normalized ratio; LV, left ventricular; LVAD, left ventricular assist device; NT-proBNP, *N*-terminal pro-brain natriuretic peptide; PF-LVAD, pulsatile flow-left ventricular assist device; RV, right ventricular; RVD, right ventricular dysfunction; RVF, right ventricular failure; RVSWI, right ventricular stroke work index; sS, systolic strain.

nto, chi terapia palliativa

Prediction of right v ventricular assist dev review and meta-ana studies

Diego Bellavia[1]*, Attilio Iacovoni[2], C
Michele Pilato[1], Sudhir S. Kushwaha
Valentina Agnese[1], Calogero Falletta
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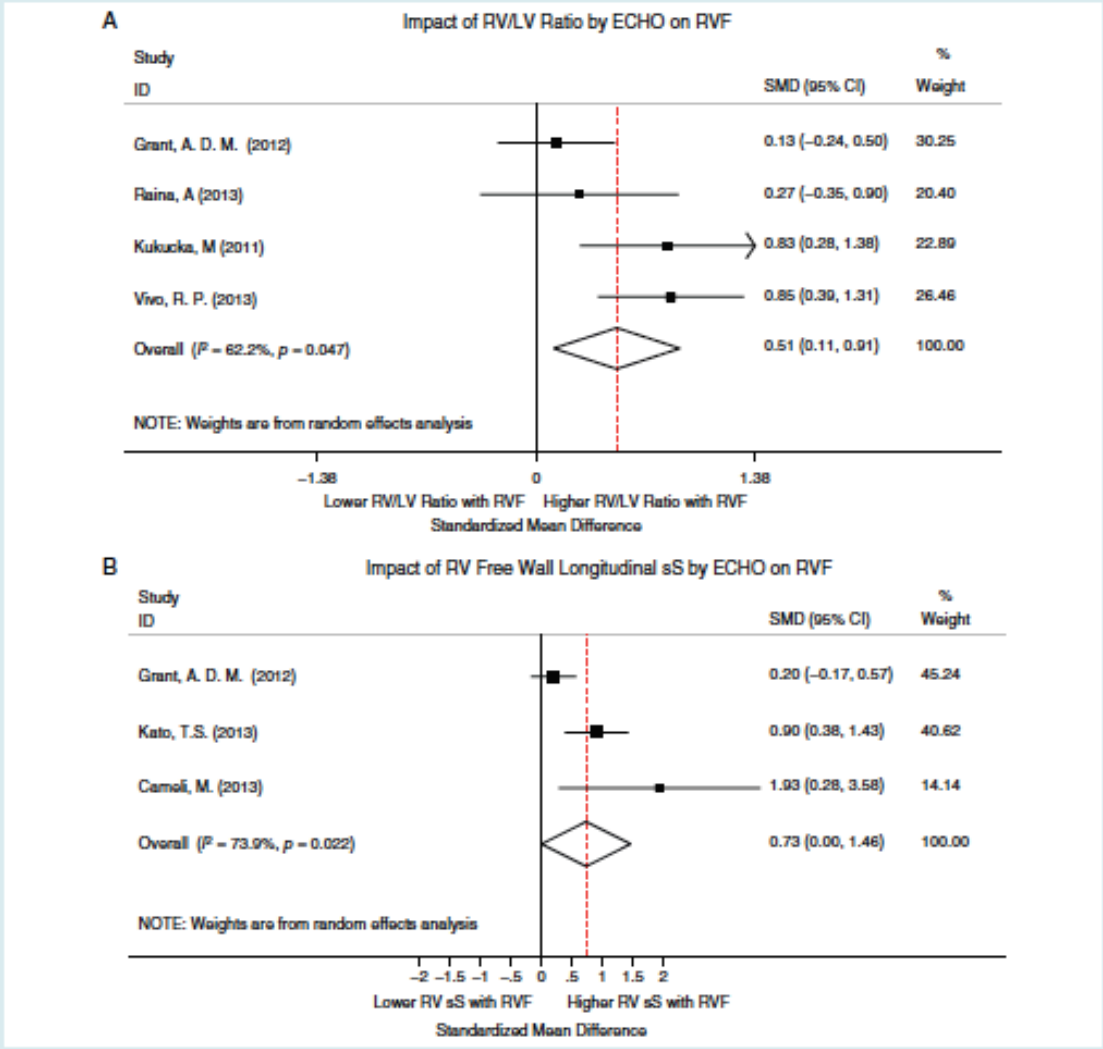


Figure 8 Forest plot of the pooled estimate of the most significant echocardiographic measurements of right ventricular failure (RVF). (*A*) Forest plot of the pooled estimate of the impact of right ventricular/left ventricular basal diameter ratio (RV/LV ratio) on RVF (analysis not stratified). (*B*) Forest plot of the pooled estimate of the impact of RV free wall longitudinal systolic strain (sS) on RVF (analysis not stratified). CI, confidence interval; SMD, standardized mean difference.

I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

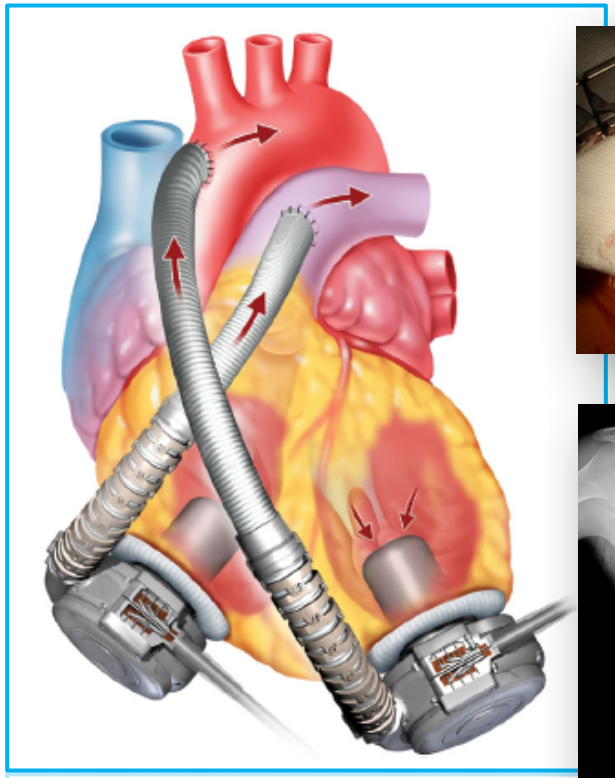
12-Month Cumulative Incidence

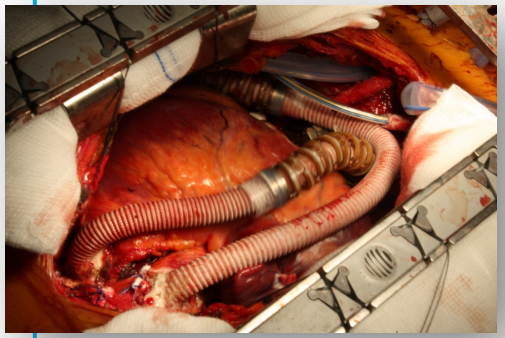
Patients surviving to 3 months with LVAD support alone (n = 6,118)	RHF Status at 3 Months	Mortality	Rehospitalization	Stroke	1st GI Bleed
	No RHF (n = 5,511)	6.9%	65.2%	7.4%	14.8%
	Mild RHF (n= 311)	16.7%	73.2%	9.5%	24.2%
	Moderate RHF (n = 296)	28.1%	71.2%	11.0%	23.6%
		P<0.0001	P<0.0001	P = 0.0095	P<0.0001

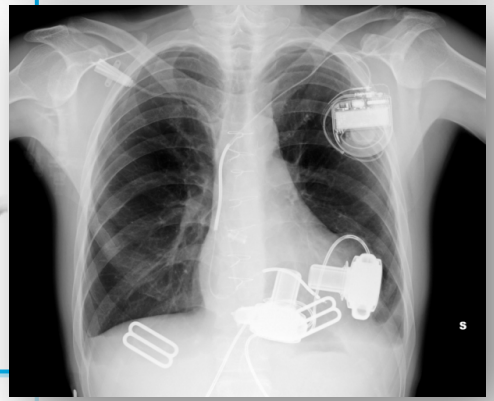
Rame, J.E. et al. J Am Coll Cardiol. 2021;78(23):2294-2308.

Patients from the Society of Thoracic Surgeons Intermacs database who survived to 3 months on left ventricular assist device (LVAD) support alone were divided into categories on the basis of right heart failure (RHF) status at 3 months. Compared with patients with mild and moderate right heart failure, those with no right heart failure had a significantly lower 12-month cumulative incidence of death, rehospitalization, stroke and gastrointestinal (GI) bleeding.

HeartMate3 Bi-VAD



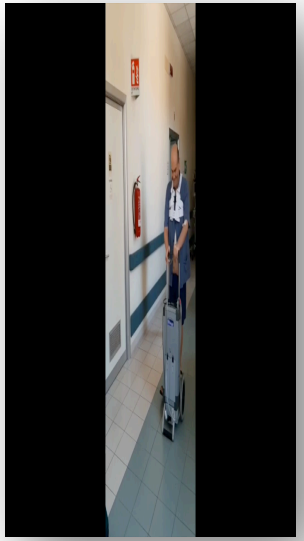


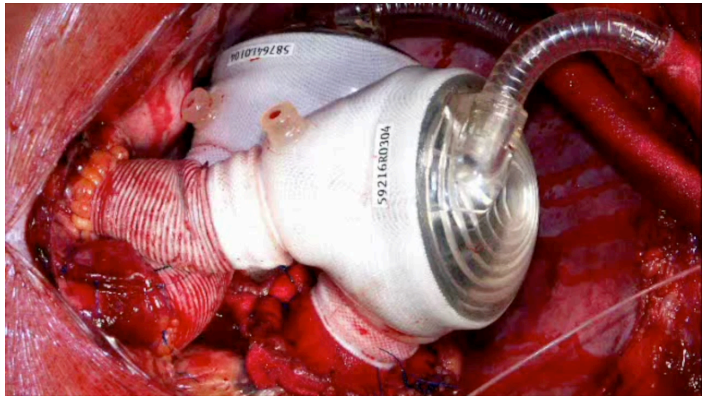


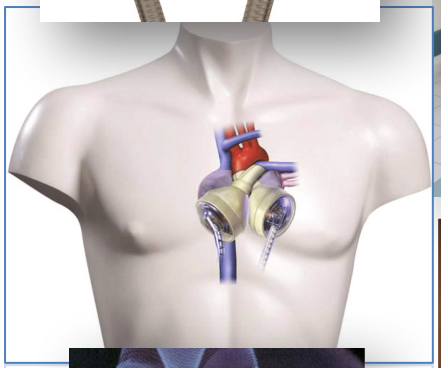
Bridge to Transplantation

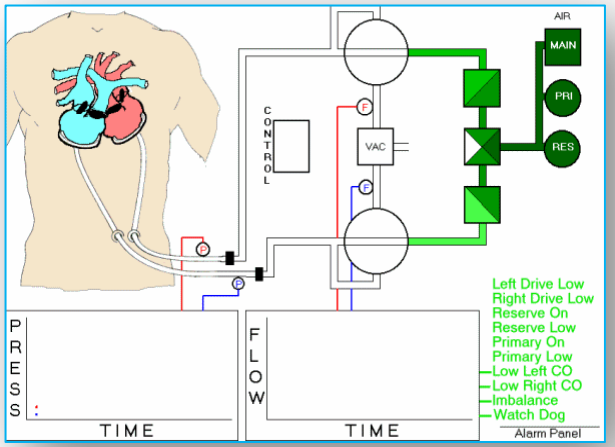
I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

CardioWest TAH

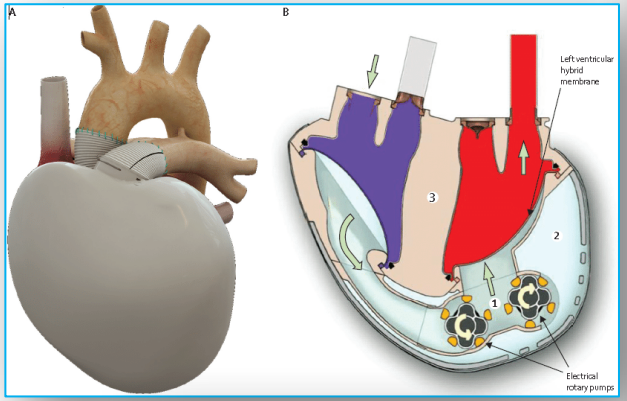








CARMAT TAH



CARMAT

HEMOCOMPATIBLE[1]

BIOLOGIC
Biocompatible material for blood contact surfaces [3]

PULSATILE [2]

MECHANIC
Hydraulic pump mimics diastole & systole

AUTO-REGULATED [2]

ELECTRONIC
Automated response to the patients' physiological needs

Biological contact surfaces →

- 4 biological valves
- 2 hybrid membranes
  - Blood side: layer of bovine pericardium
  - Pump side: layer of polyurethane
- Cavities' walls covered by ePTFE

No shear stress[4]

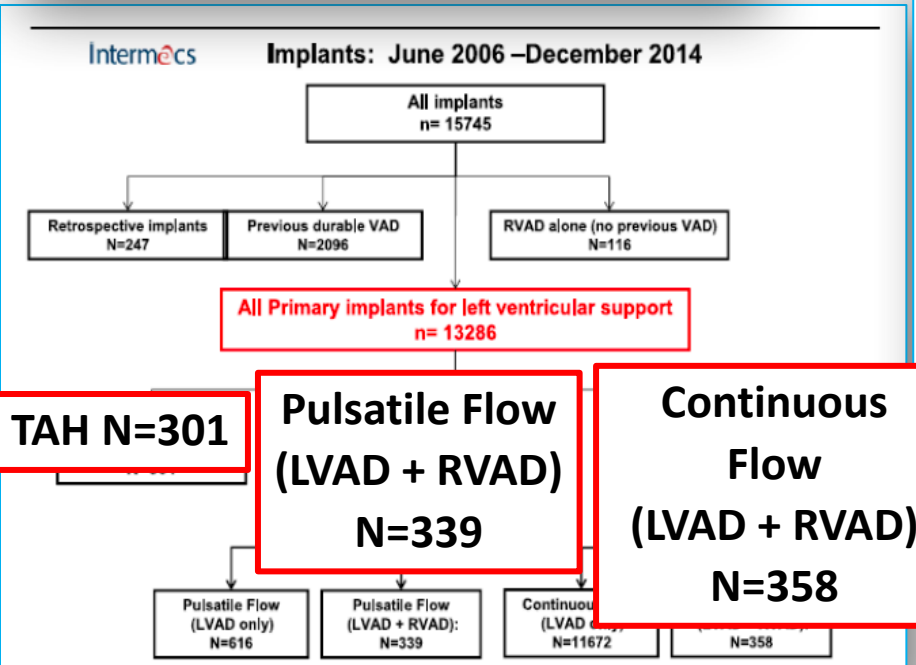
Fill-to-empty displacement pump

I percorsi diagnostico-terapeutici del paziente con insufficienza cardiaca avanzata: chi LVAD, chi trapianto, chi terapia palliativa

FEATURED PAPERS

Interagency registry for mechanically assisted circulatory support report on the total artificial heart

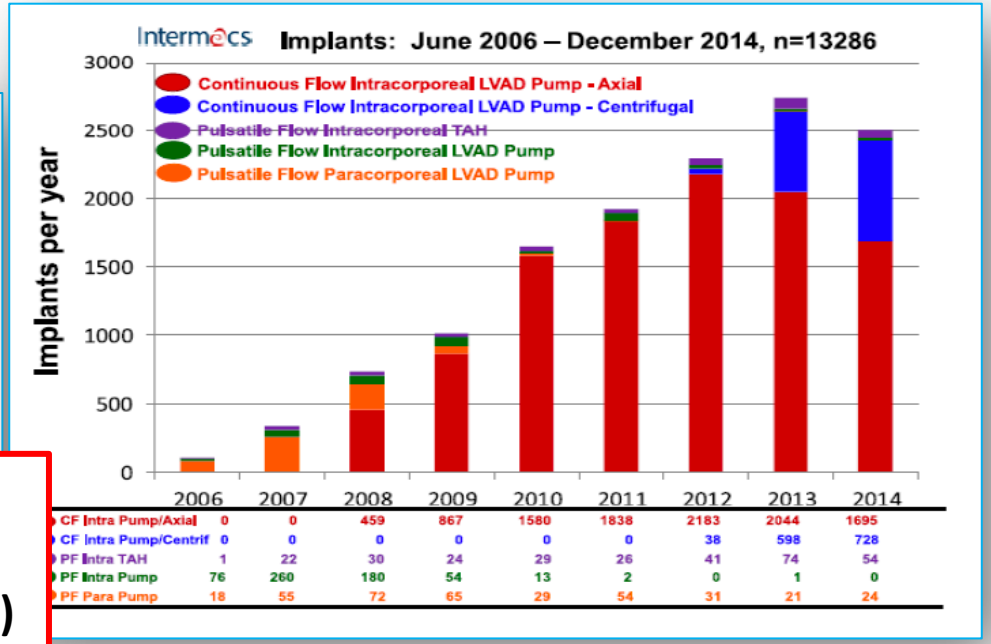
J Heart Lung Transplant 2018;37:1304–1312



TAH N=301

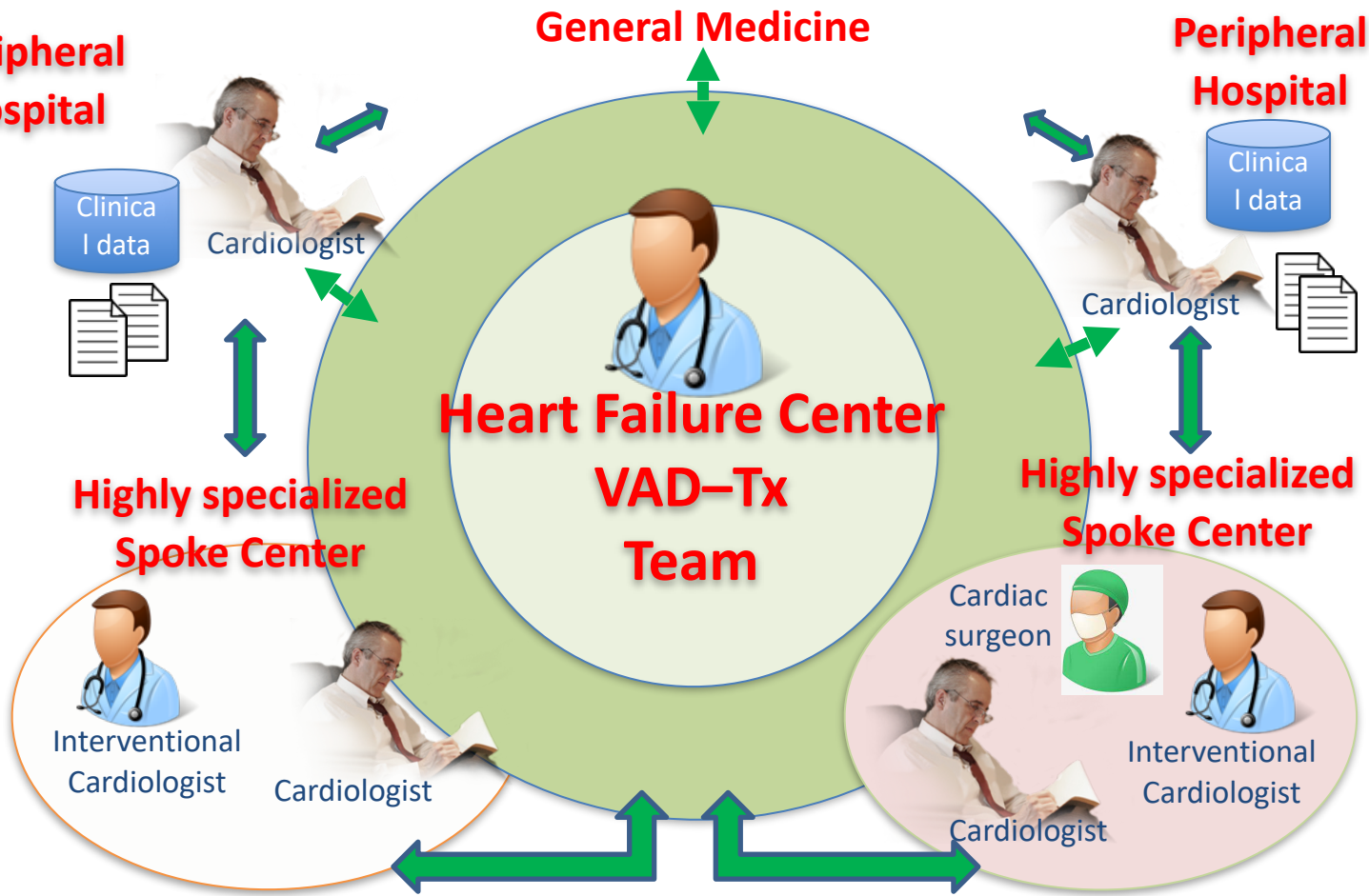
Pulsatile Flow (LVAD + RVAD) N=339

Continuous Flow (LVAD + RVAD) N=358



Pulsatile BIVAD including Total Artificial Hearts (TAHs) represented around 3% of the total devices implantation in 2014

La rete Scompenso Cardiaco Avanzato

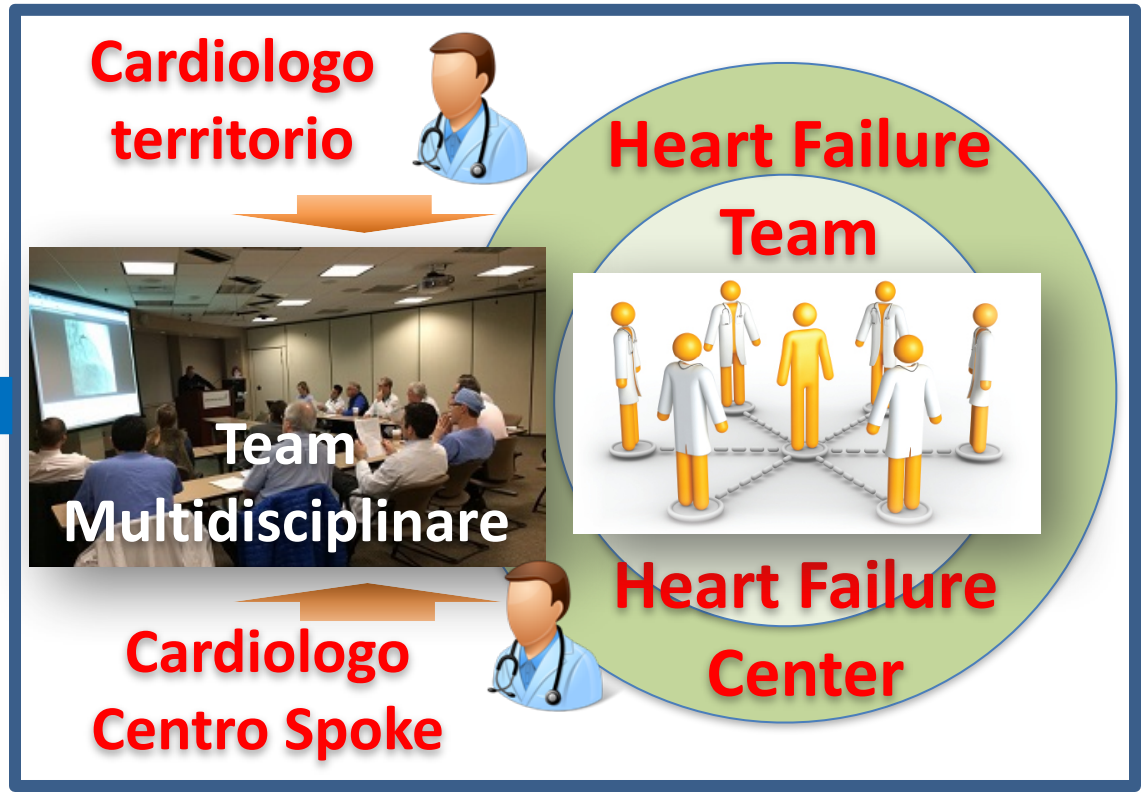


Heart Failure Center con Heart Team Multidisciplinare dedicato

Percorsi decisionali

Condivisione di strategie

Percorso decisionale personalizzato e risultato ottimale del trattamento



Conclusioni

- Il **Trapianto** è il **Gold Standard** per il trattamento dello scompenso cardiaco refrattario.
- **L'Assistenza Ventricolare Meccanica** è oggi una soluzione terapeutica superiore alla terapia medica in molti pazienti con scompenso avanzato in attesa di Tx.
- Una collaborazione stretta tra cardiologo e **Heart Failure Center** è determinante per una gestione ottimale del paziente nel suo percorso clinico, per l'indicazione a trapianto o VAD e alla scelta del Timing chirurgico.

Grazie per l'attenzione

AZIENDA OSPEDALIERA SAN CAMILLO FORLANINI