



CHIRURGISCHE HERZINSUFFIZIENZ-THERAPIE

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Definition der Herzinsuffizienz

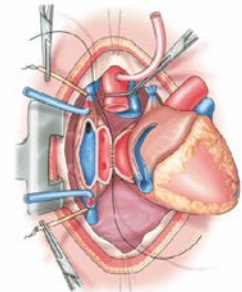
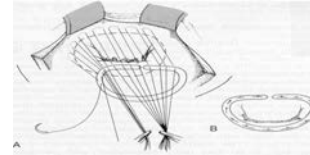
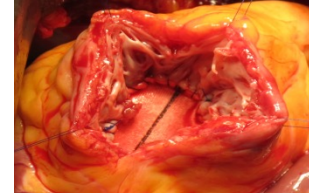
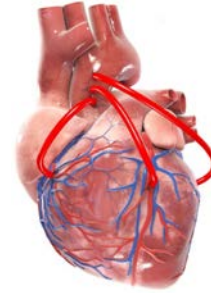


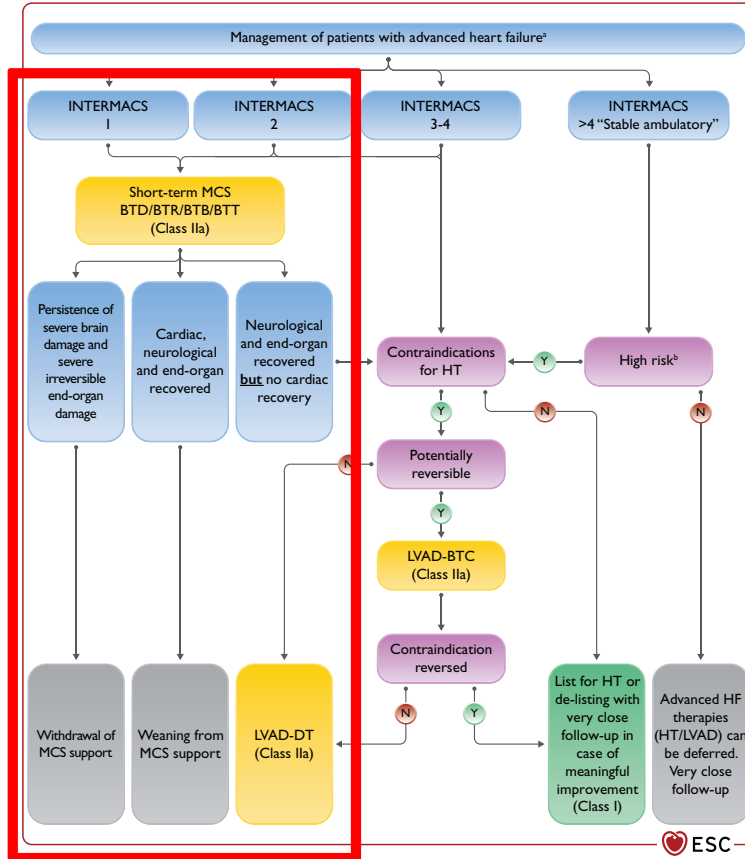
„Die Unfähigkeit des Herzens, trotz eines ausreichenden venösen Rückstroms eine für den Metabolismus der peripheren Organe ausreichende Menge an Blut durch den Organismus zu pumpen.“

Die zehn häufigsten Todesursachen – 2018

ICD-10 Pos.-Nr.	Todesursachen Sterbefälle insgesamt 2018 nach den 10 häufigsten Todesursachen der ICD-10	Gestorbene ¹	
		Anzahl	Anteil in %
I25	Chronische ischämische Herzkrankheit	76.273	8,0
I21	Akuter Myokardinfarkt (Herzinfarkt)	46.207	4,8
C34	Bösartige Neubildung der Bronchien und der Lunge (Lungen- und Bronchialkrebs)	44.853	4,7
F03	Nicht näher bezeichnete Demenz	44.670	4,7
I50	Herzinsuffizienz (Herzschwäche, Herzmuskelschwäche)	37.709	3,9
J44	Sonstige chronische obstruktive Lungenkrankheit	32.796	3,4
I11	Hypertensive Herzkrankheit	23.301	2,4
I48	Vorhofflattern und Vorhofflimmern	21.523	2,3
R99	Sonstige ungenau oder nicht näher bezeichnete Todesursachen	19.884	2,1
J18	Pneumonie, Erreger nicht näher bezeichnet	19.736	2,1

- Optimale medikamentöse Therapie
- Koronarchirurgie
- Klappenchirurgie
- Ventrikelrekonstruktion (Dor-Plastik)
- ECMO / Impella
- Assistsysteme
- Herztransplantation





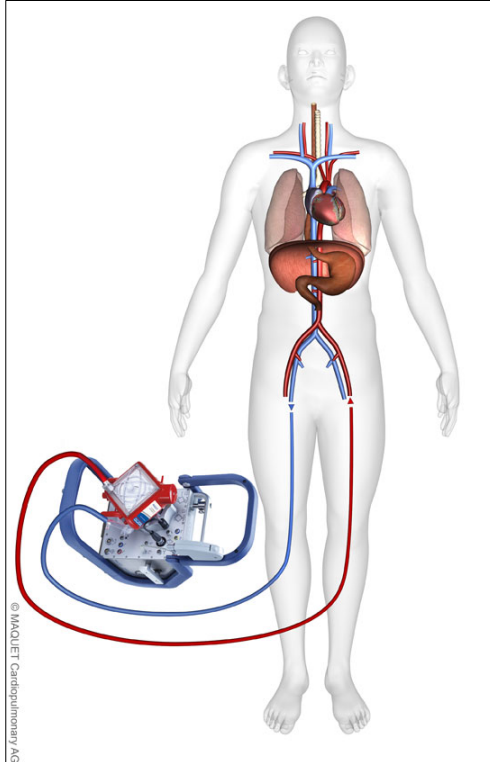
INTERMACS level	NYHA Class	Description	Device
1. Cardiogenic shock "Crash and burn"	IV	Haemodynamic instability in spite of increasing doses of catecholamines and/or mechanical circulatory support with critical hypoperfusion of target organs (severe cardiogenic shock).	ECLS, ECMO, percutaneous support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

2016 ESC guidelines Heart Failure, EHJ 2016; 37:2129-2200

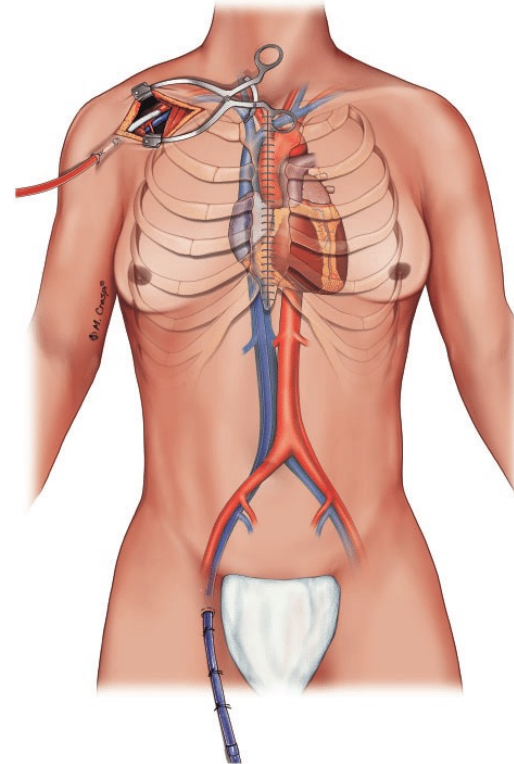


Zentrifugalpumpe + Oxygenator

femo-femoral



axillär-femoral



ECLS Registry Report

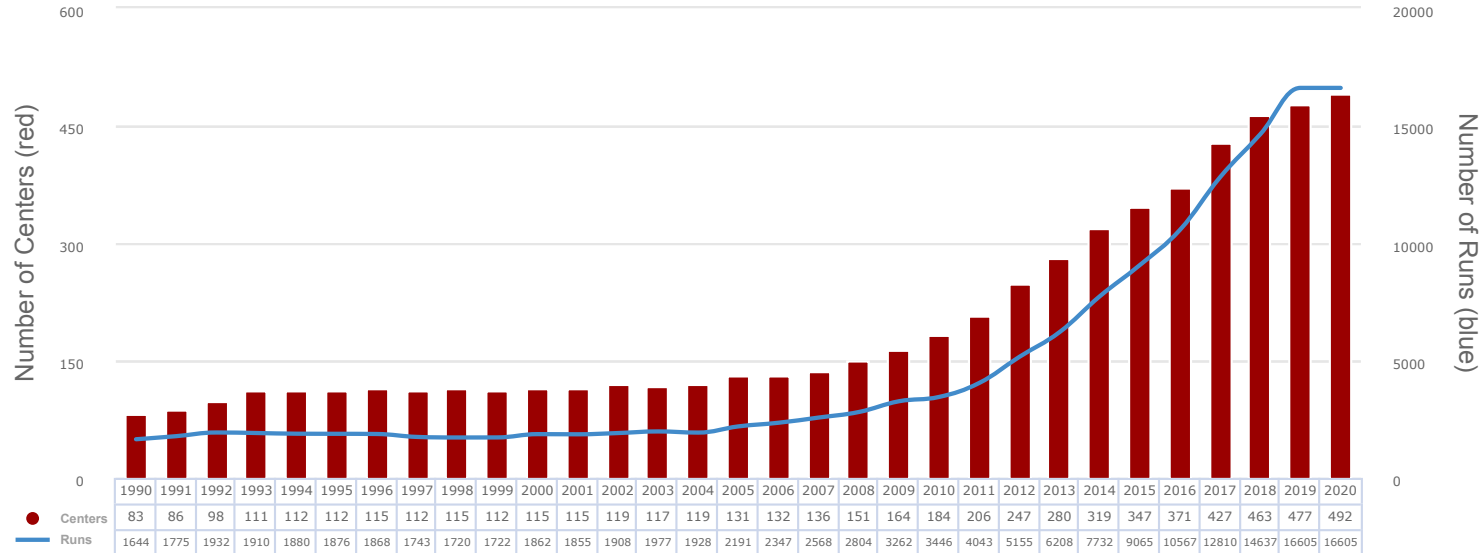
International Summary

April, 2021

Report data through 2020

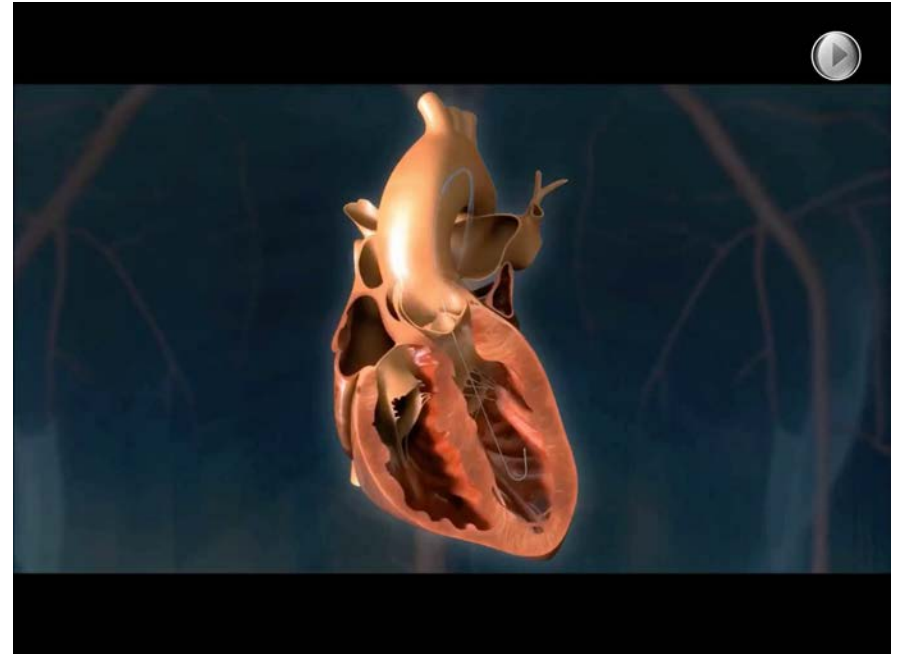


Centers by year



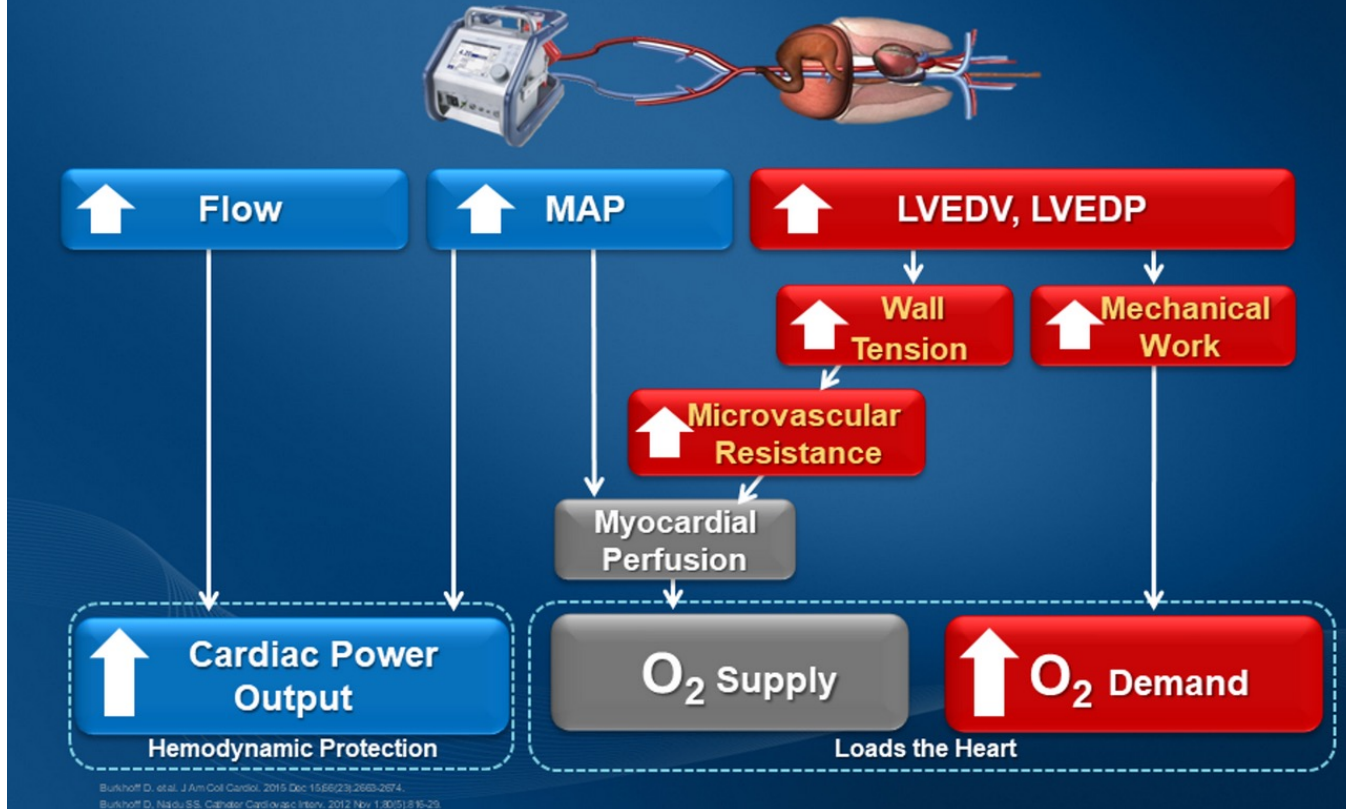


bis zu 6 l Fluss
30 Tage zugelassen

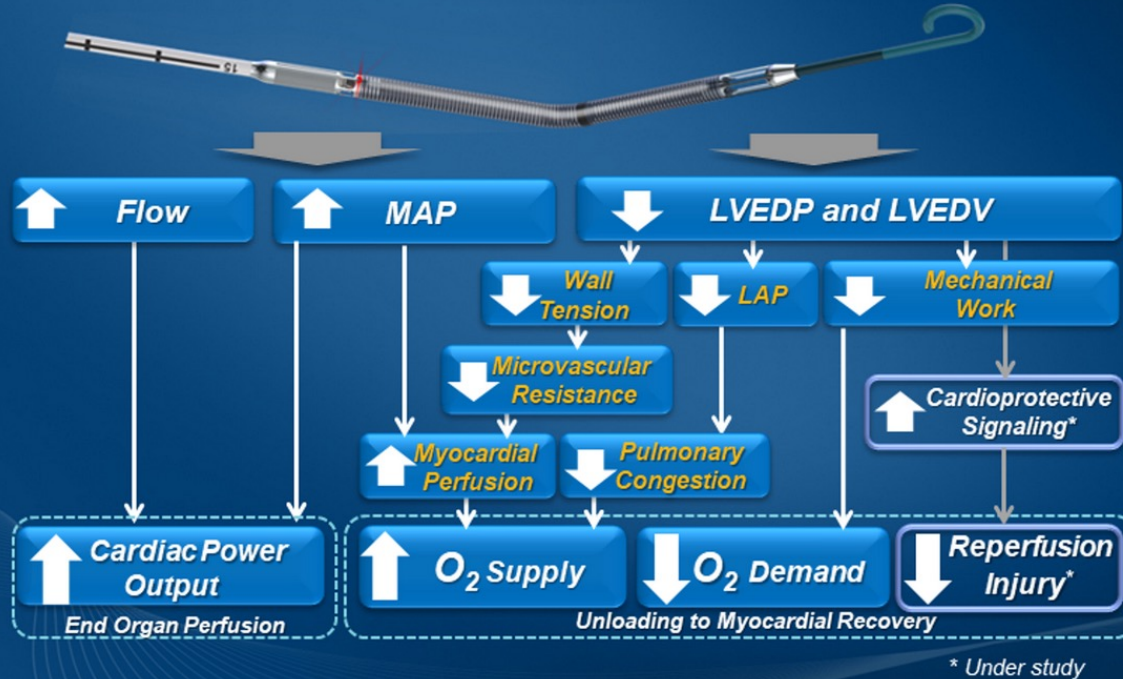


ECMO vs. Impella

HEMODYNAMIC EFFECTS OF ECMO



HEMODYNAMIC EFFECTS OF IMPELLA® DEVICES



* Under study

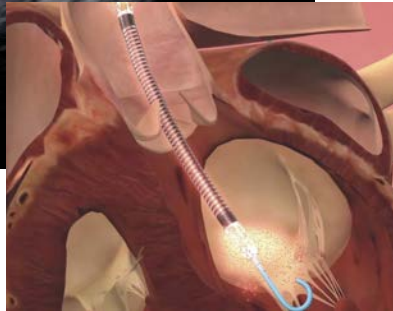
Finkele R. et al. J Am Coll Cardiol 2004
den Ull CA. et al. Eur Heart J 2010
Mendoza DO. et al. Am Heart J 2007
Torgersen C. et al. Crit Care 2009
Tone-Amlone G. et al. J Card Fail 2009

Suga H. Am J Physiol 1979
Suga H. et al. Am J Physiol 1981
Burkhoff D. et al. Am J Physiol Heart Circ Physiol 2006
Burkhoff D. Mechanical Properties Of The Heart And its Interaction With The Vascular System. (White Paper) 2011

Sauren LDC. et al. Artif Organs 2007
Meyns B. et al. J Am Coll Cardiol 2003
Remmelink M. et al. Catheter Cardiovasc Interv 2007
Acel RA. et al. J Vasc Med Biol 2000
Lam K. et al. Clin Res Cardiol 2009

Reesink KD. et al. Chest 2004
Esposito M. et al. J Am Coll Cardiol 2010
Remmelink M. et al. Catheter Cardiovasc Interv 2010
Haido SS. Circulation 2011
Weber D.M. et al. Cardiac Interventions Today Supplement Aug/Sep 2009

ECMO vs. Impella



ECMO:

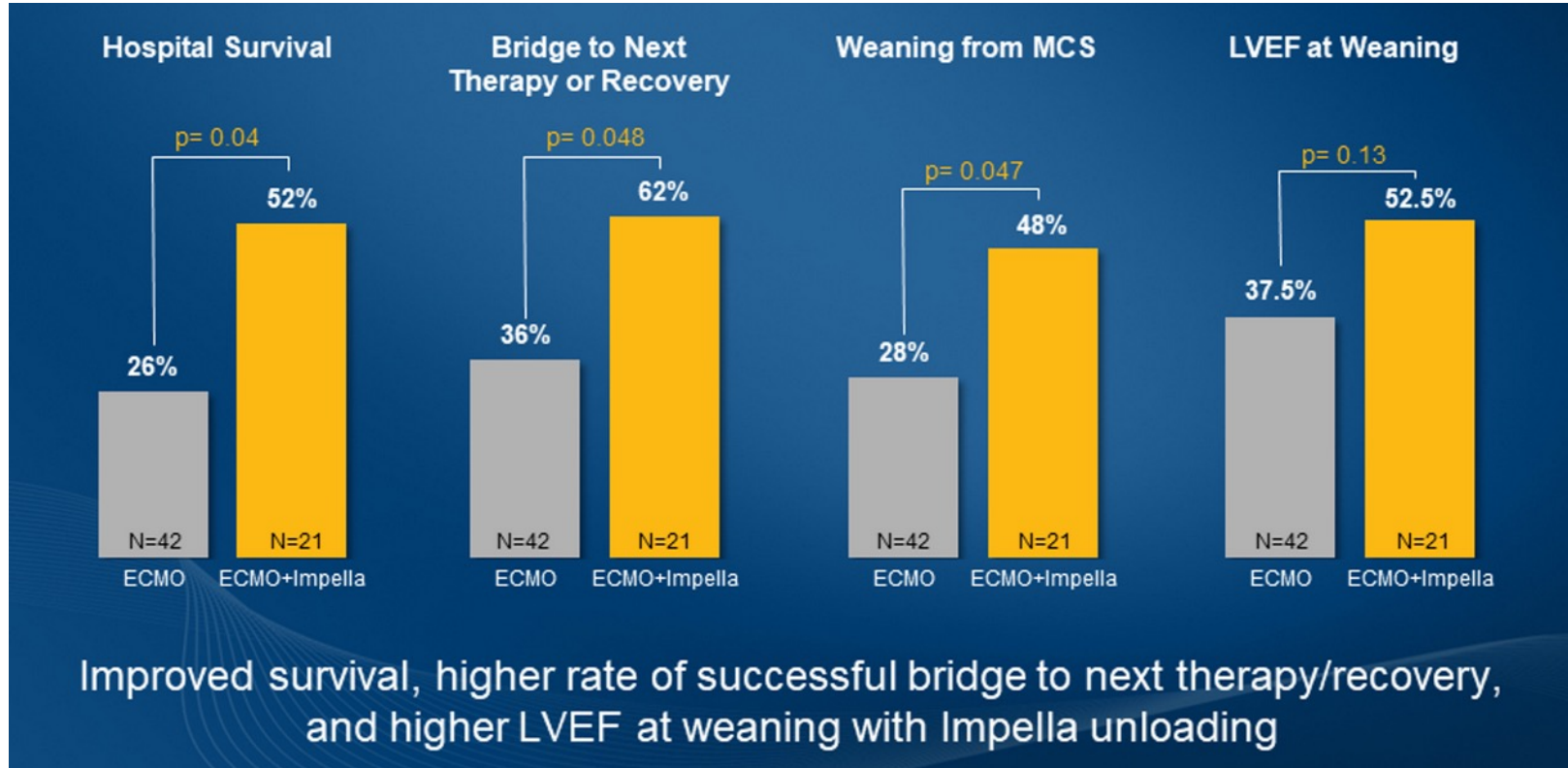
Vorteil: Oxygenator, gute RH-Entlastung

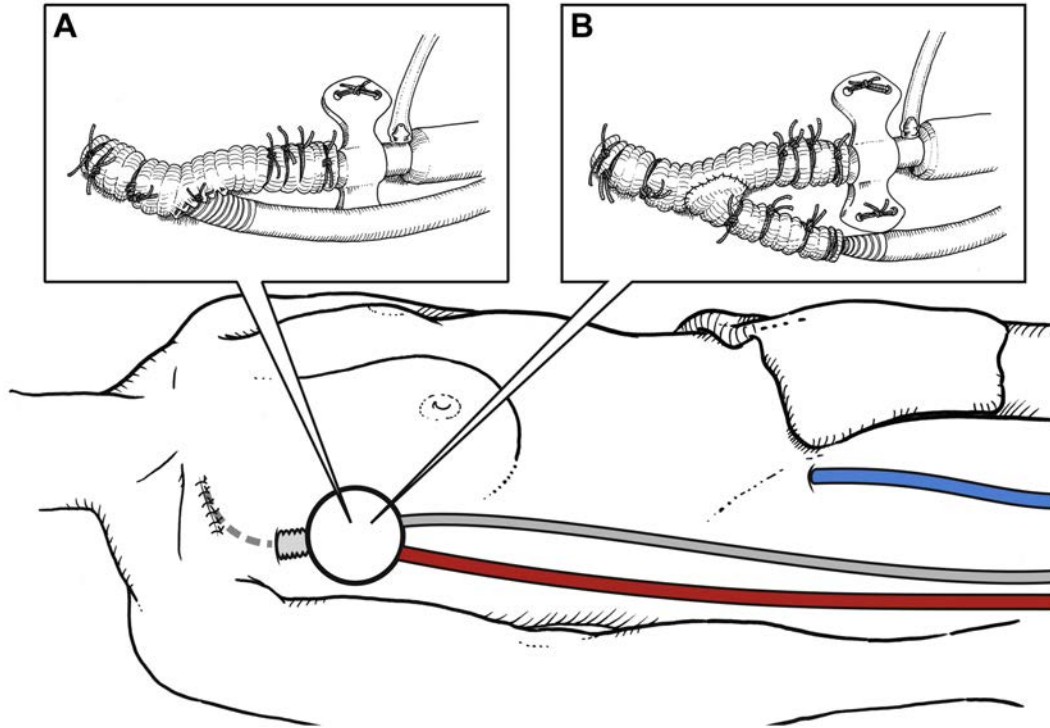
Nachteil: keine Entlastung des LV

Impella:

Vorteil: LV-Entlastung

Nachteil: keine Oxygenierung
keine RV-Entlastung

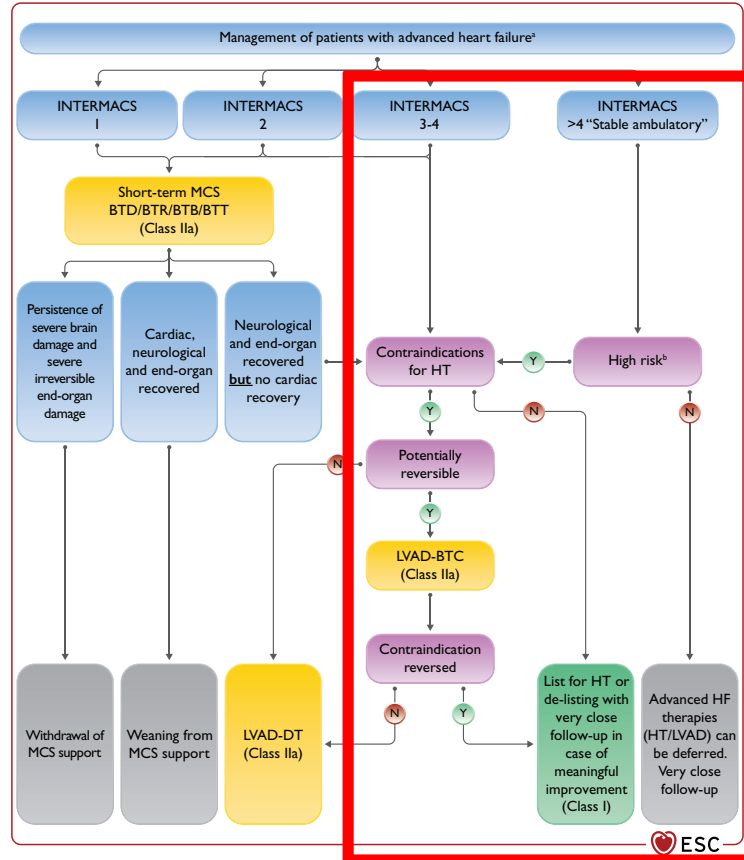






Chronische Herzinsuffizienz

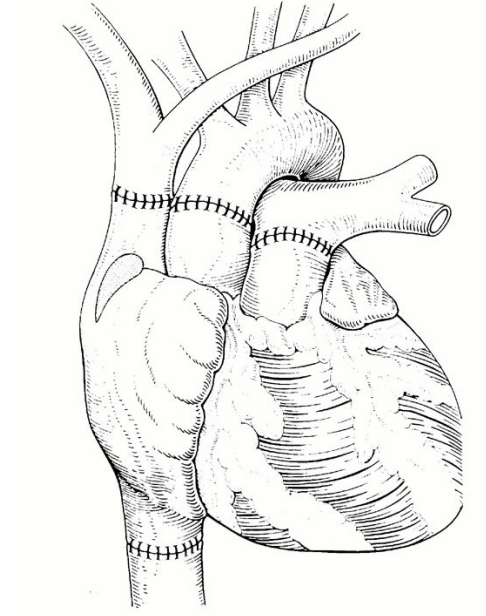
- Keine ausreichende Erholung nach ECMO oder Impella
- Ischämische Kardiomyopathie (ICM)
- Dilatative Kardiomyopathie (DCM)

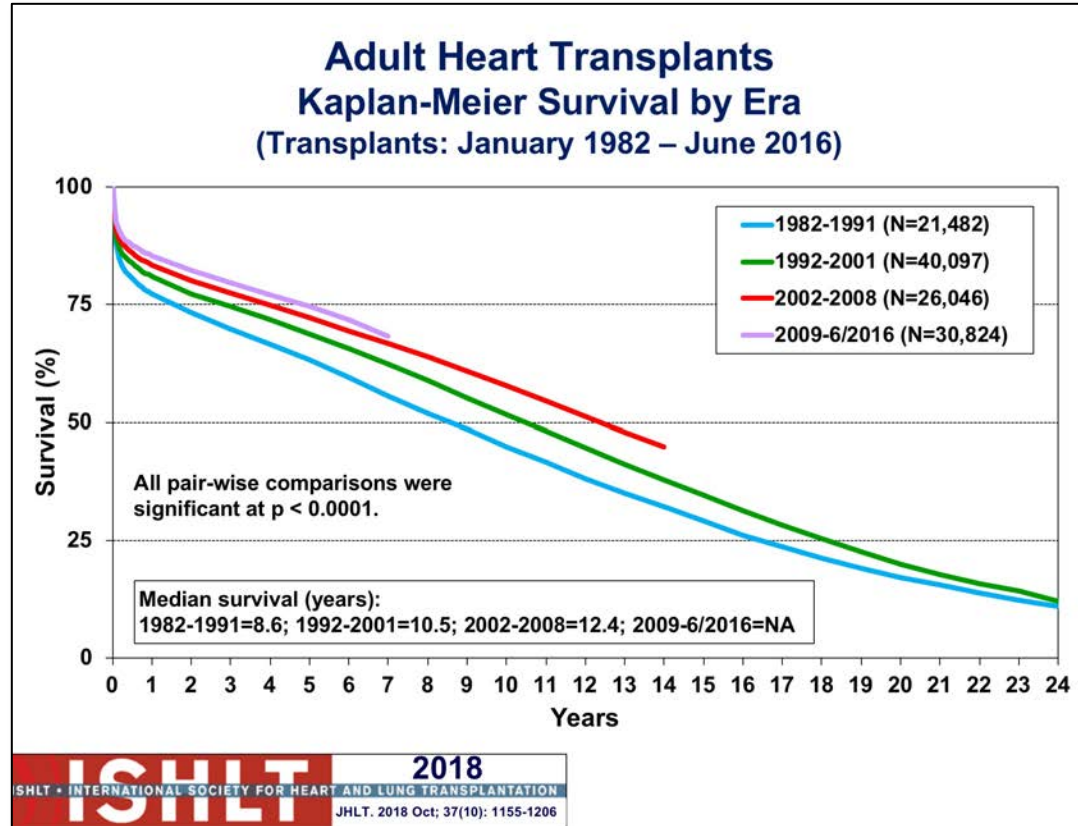


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2016 ESC guidelines Heart Failure, *EHJ* 2016; 37:2129-2200

Herztransplantation



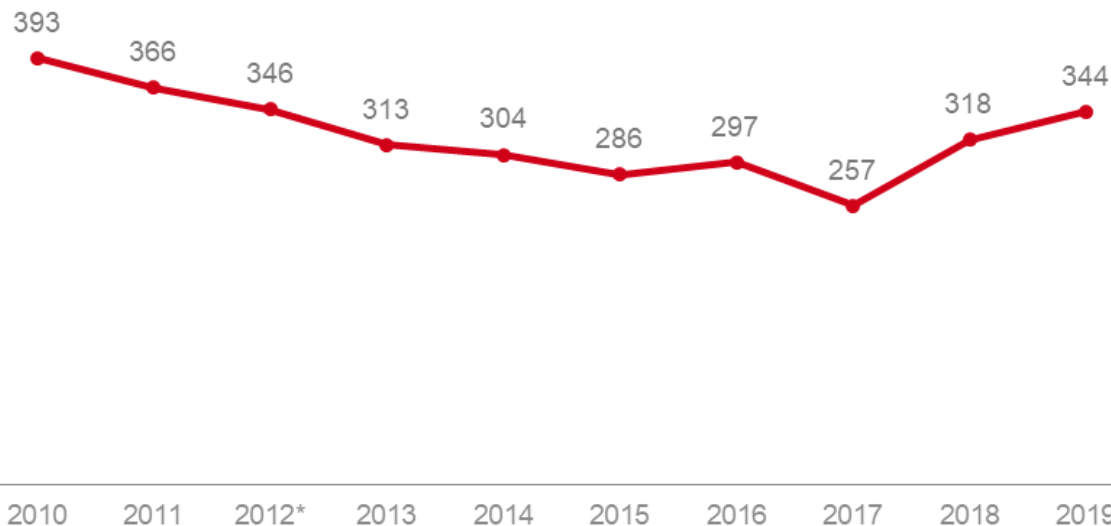


Herztransplantation

Herztransplantationen in Deutschland



Anzahl inkl. Kombinationen



* inkl. 1 Transplantation nach Dominospende

Quelle: DSO Tätigkeitsbericht 2020

49

Warteliste Herztransplantation inkl. Anmeldungen und Abgängen

Deutschland 2019 | Anzahl

DSO 350

559 Anmeldungen



1.136 Warteliste 31.12.2019



● TRANSPLANTABEL **722** ● NICHT TRANSPLANTABEL **414**

529 Abgänge



● TRANSPLANTIERT **344** ● SONSTIGES **84** ● VERSTORBEN **101**

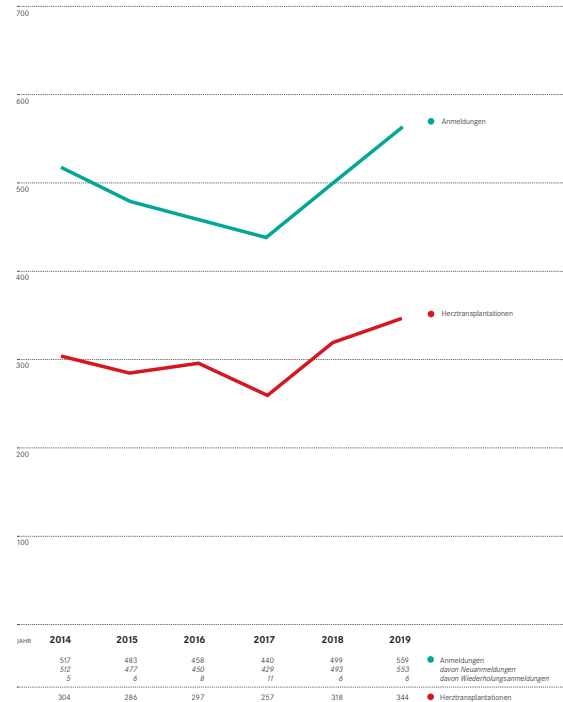
Quelle: Eurotransplant

47

Anmeldungen und Herztransplantationen

Deutschland 2014 bis 2019 | Anzahl

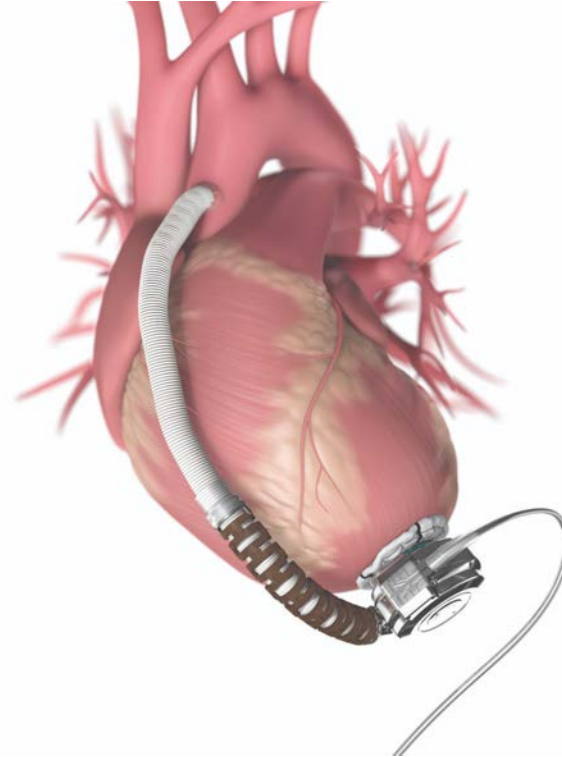
DSO 350



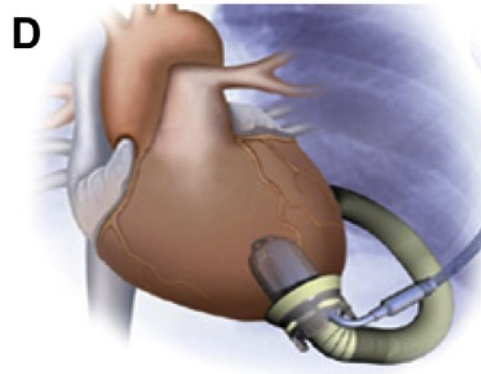
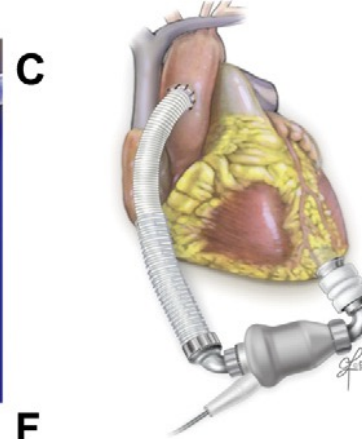
Quelle: Eurotransplant

Quelle: DSO Tätigkeitsbericht 2020

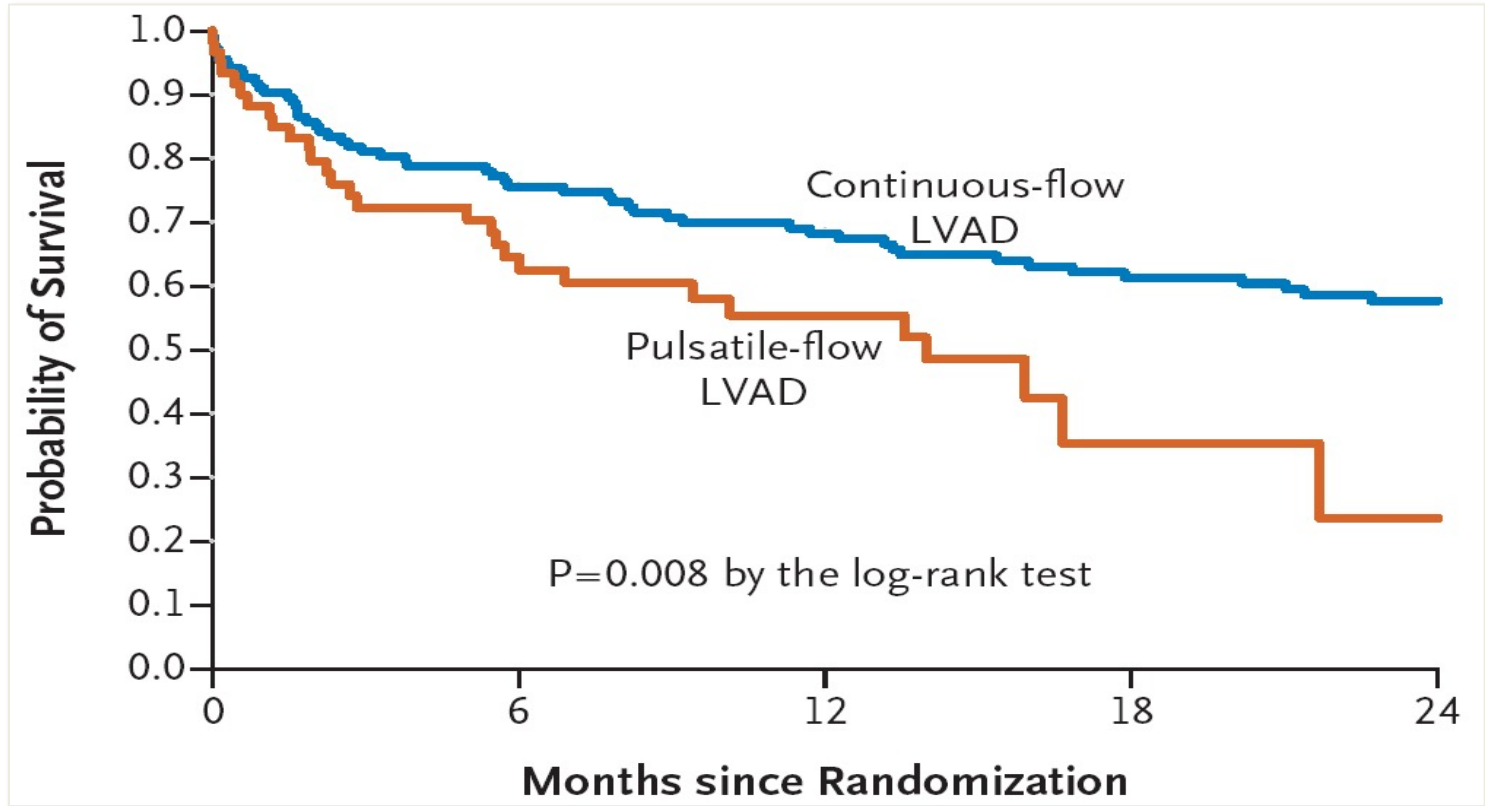
Mechanische Kreislaufunterstützung



Leftventricular Assist Device (LVAD)



Leftventricular Assist Device (LVAD)

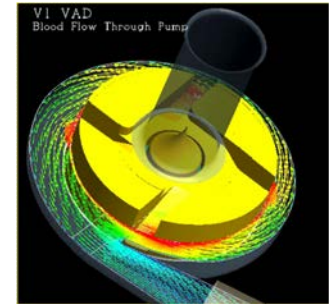


Leftventricular Assist Device (LVAD)

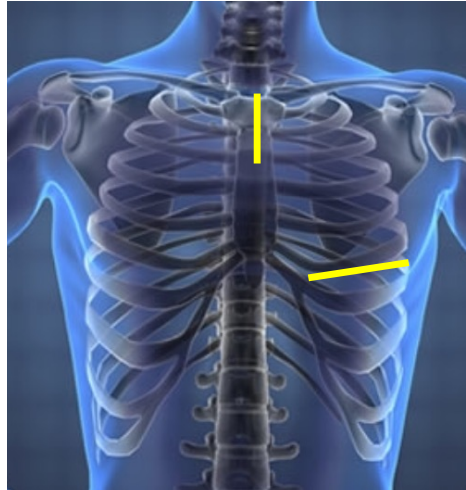
HeartWare



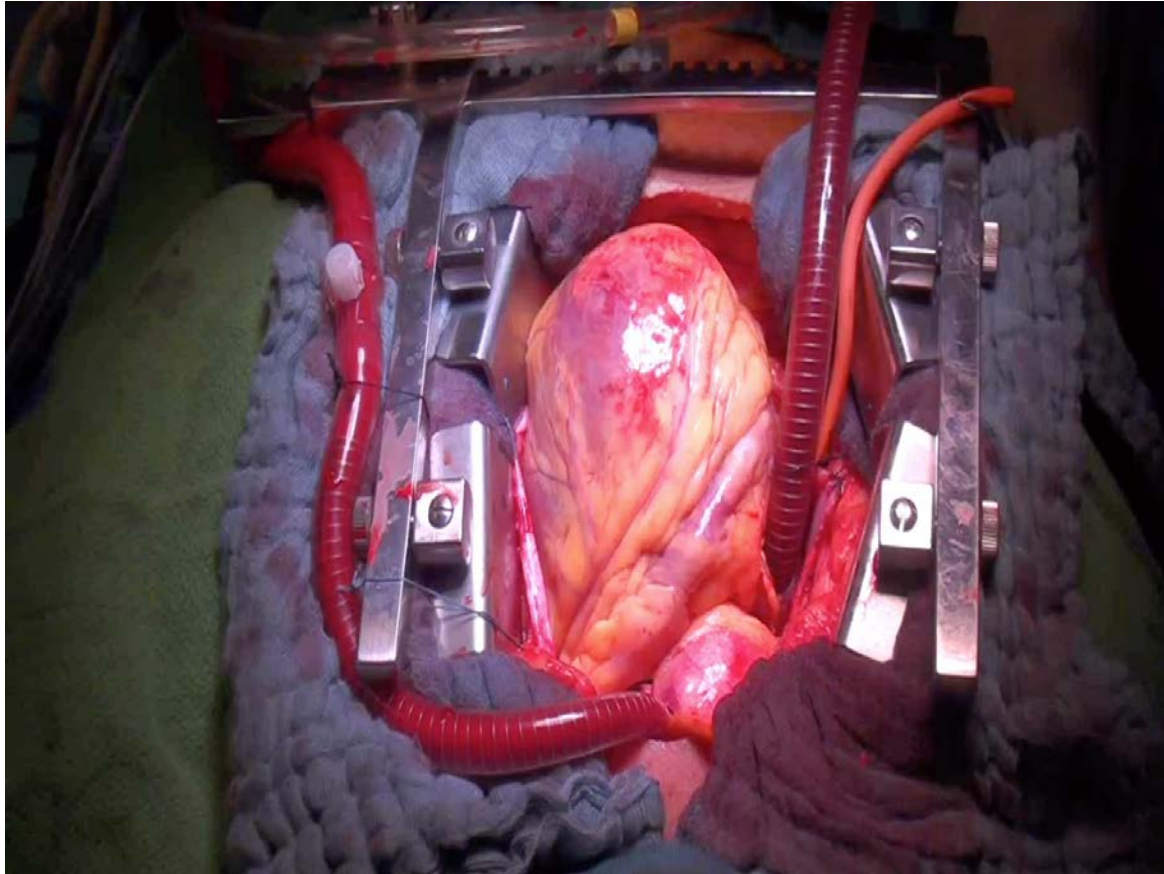
Heart Mate III



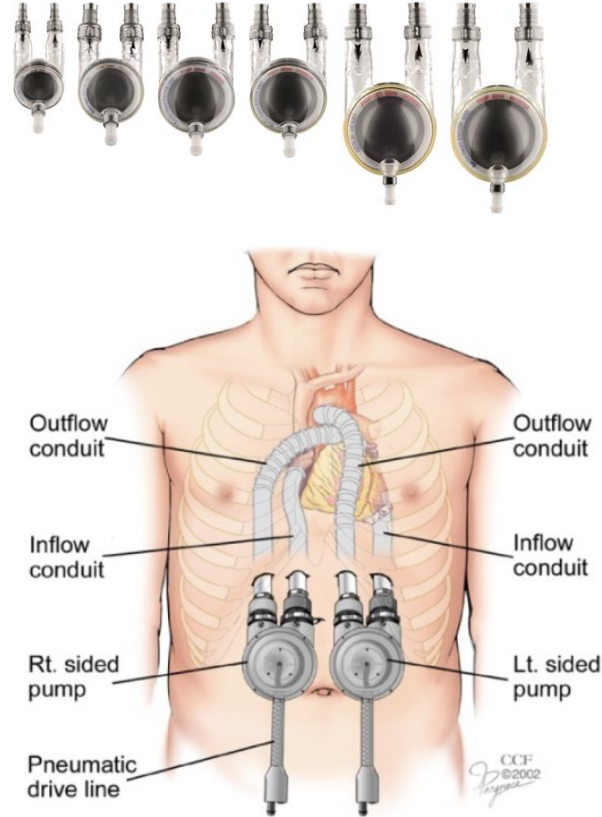
LVAD-Implantation



LVAD-Implantation



Biventricular Assist Device (BVAD)





Successful support of biventricular heart failure patients by new EXCOR® Adult pumps with bileaflet valves: a prospective study

Bastian Schmack¹ · Alexander Weymann¹ · Frank Ruschitzka² · Rüdiger Autschbach³ · Philip W. Raake⁴ · Nadine Jurrmann⁵ · Ares K. Menon⁵ · Matthias Karck¹ · Markus J. Wilhelm⁶ · Arjang Ruhparwar¹

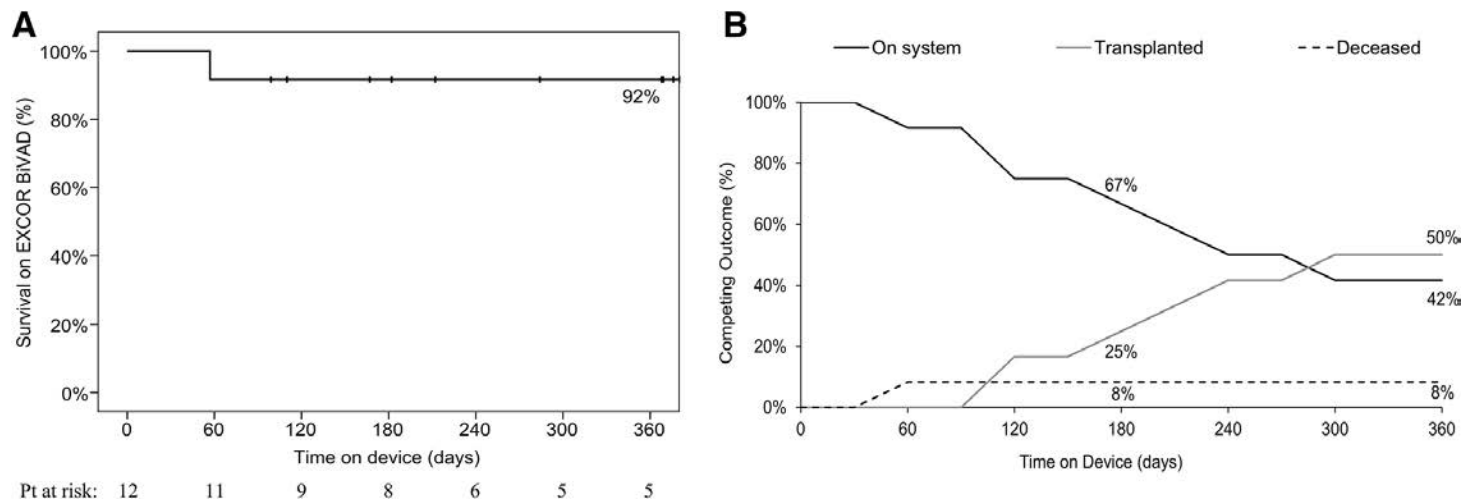
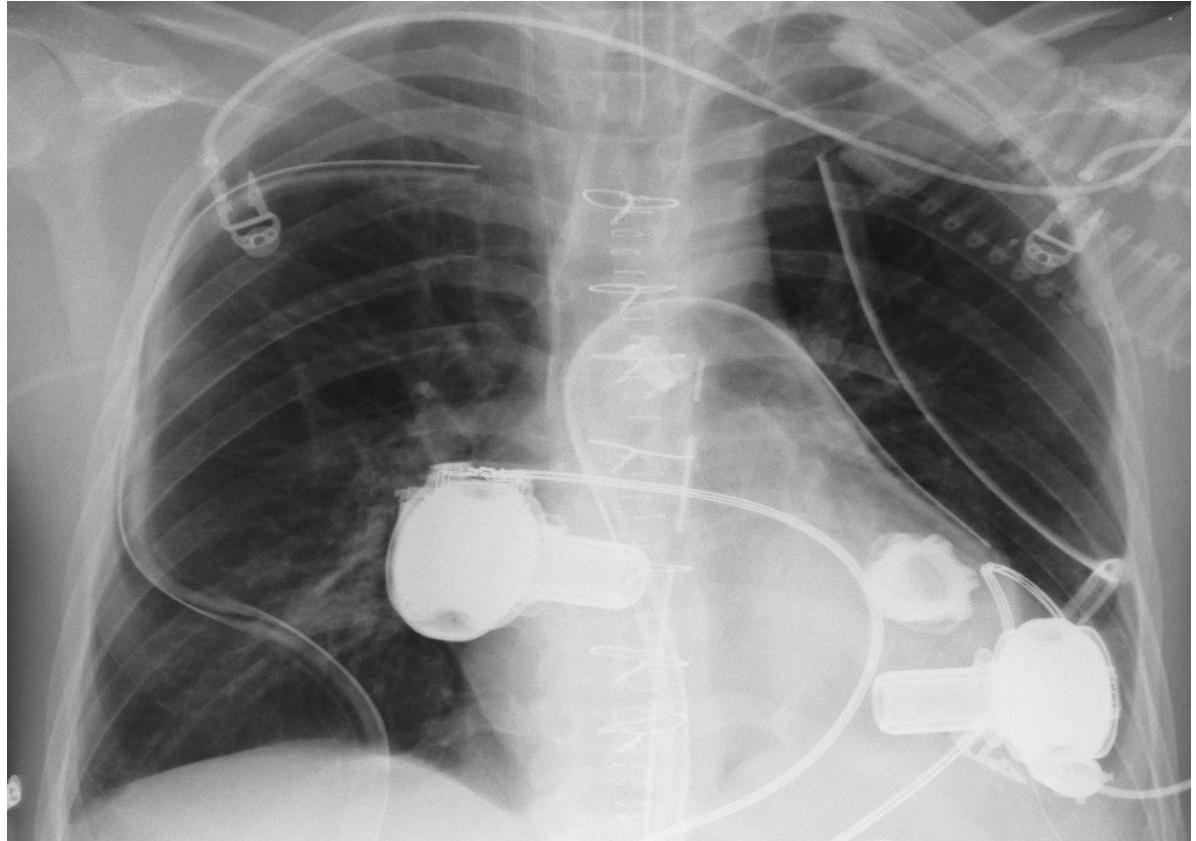
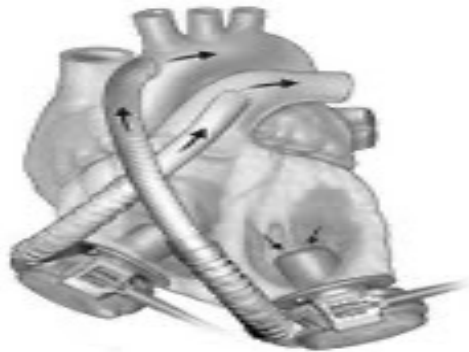
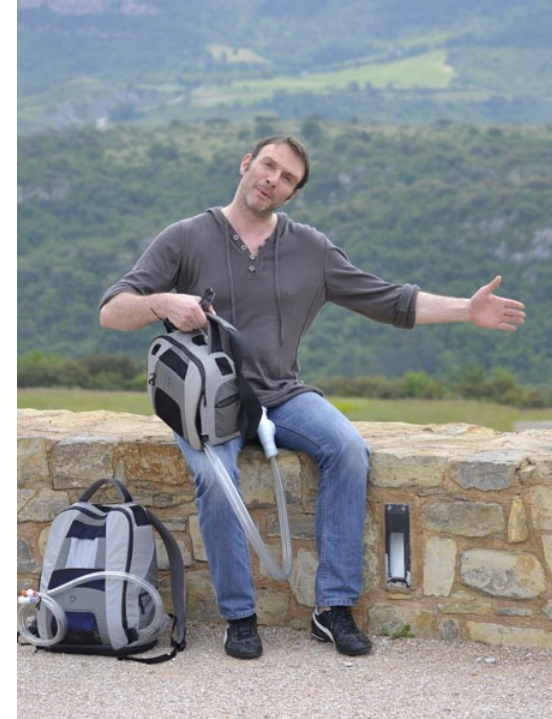
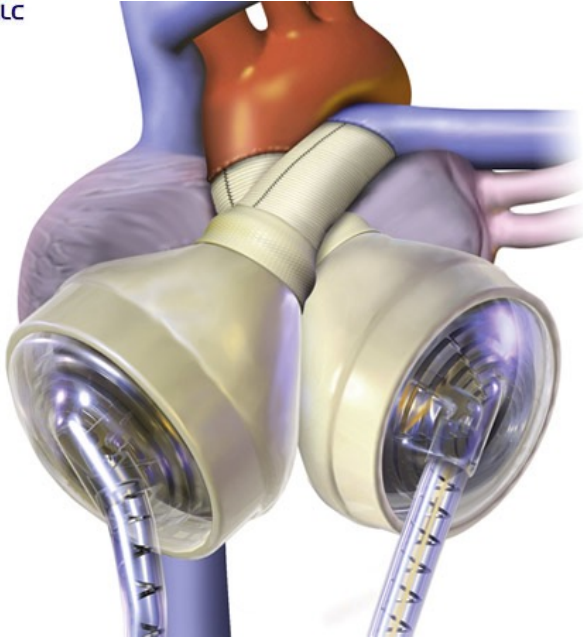


Fig. 3 The Kaplan–Meier survival (a) and competing outcome results (b) for the patients on BIVAD support

LVAD als BVAD



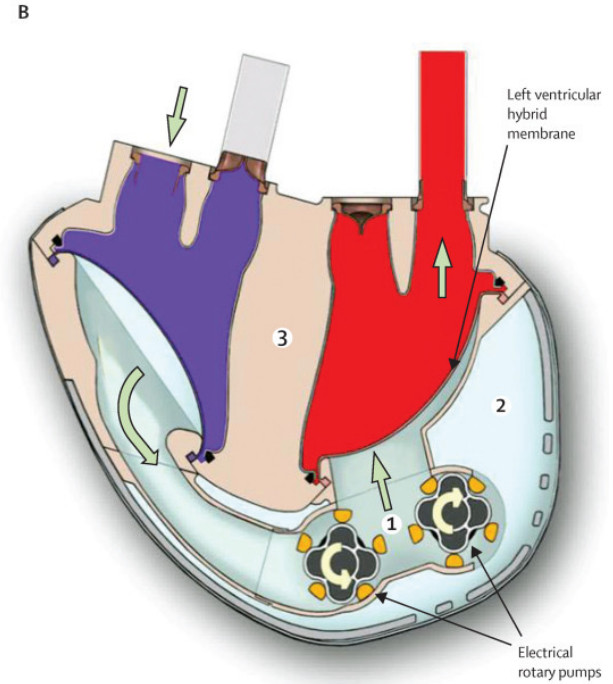
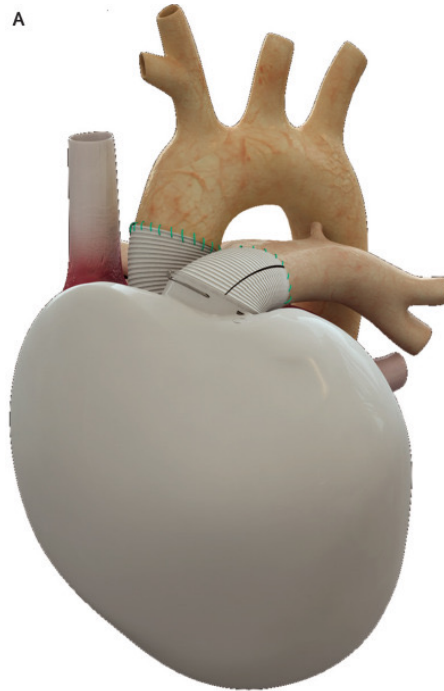
Total Artificial Heart (TAH)



Total Artificial Heart (TAH)



https://www.epo.org/news-events/events/european-inventor/finalists/2016/carpentier_de.html





„Chirurgische Behandlung der Herzinsuffizienz bei
koronaren und strukturellen Herzerkrankungen“



Fallbeispiel 1 Koronare Herzerkrankung

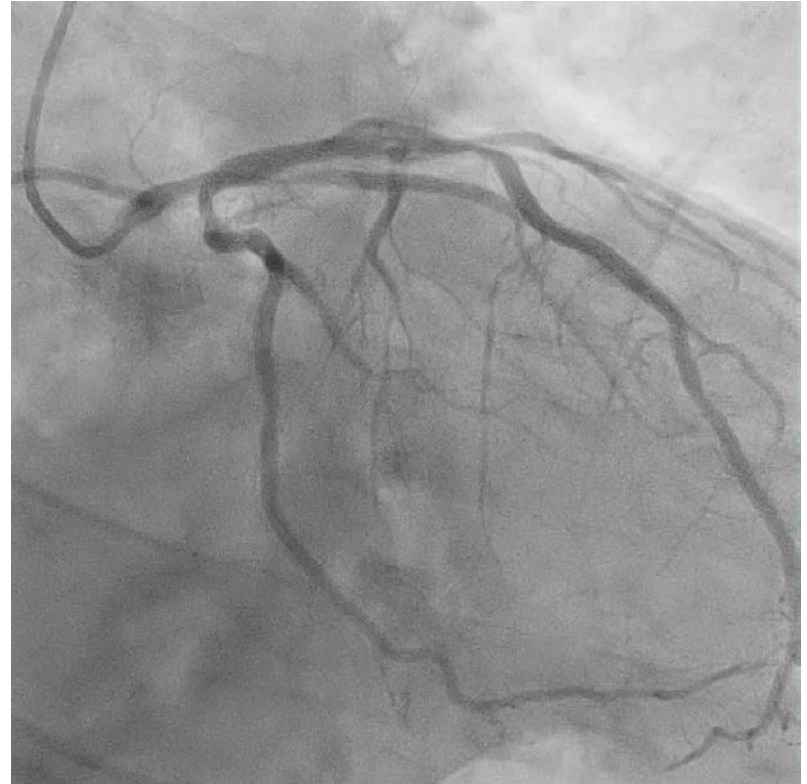
- Männlich, 71 Jahre
- ICM EF 20%
- Koronare Dreigeßäßerkrankung
 - Z.n. NSTEMI 2008
 - Z.n. PCI (90% LAD-TAXUS, 80% prox. RD1-PTCA, 75% RCA, 2/09)
 - Z.n. PCI (de-novo Stenose prox. RIVA, DES 10.1.12)
 - Z.n. PCI (elektiv DES RCA, 10.4.12)
- LSB
- Arterielle Hypertonie
- Persistierendes Vorhofflimmern
- EuroScore II: 3,1%

What is new (20)

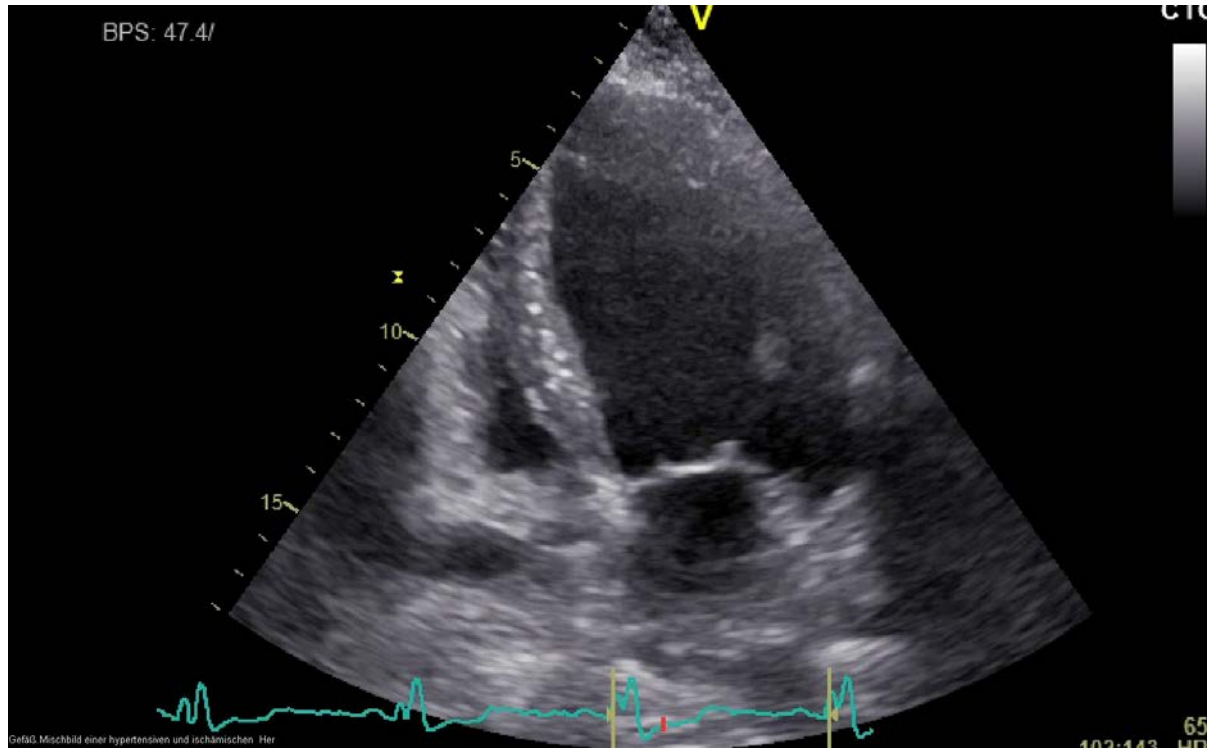


<i>Recommendations for management of patients with HF and CCS</i>			
2021 HF Guidelines	Class	2016 HF Guidelines	Class
Coronary revascularization should be considered to relieve persistent symptoms of angina (or an angina equivalent) in patients with HFrEF, CCS, and coronary anatomy suitable for revascularization, despite OMT including anti-anginal drugs.	Ila	Myocardial revascularization is recommended when angina persists despite treatment with anti-anginal drugs.	I

Fallbeispiel 1 Koronare Herzerkrankung



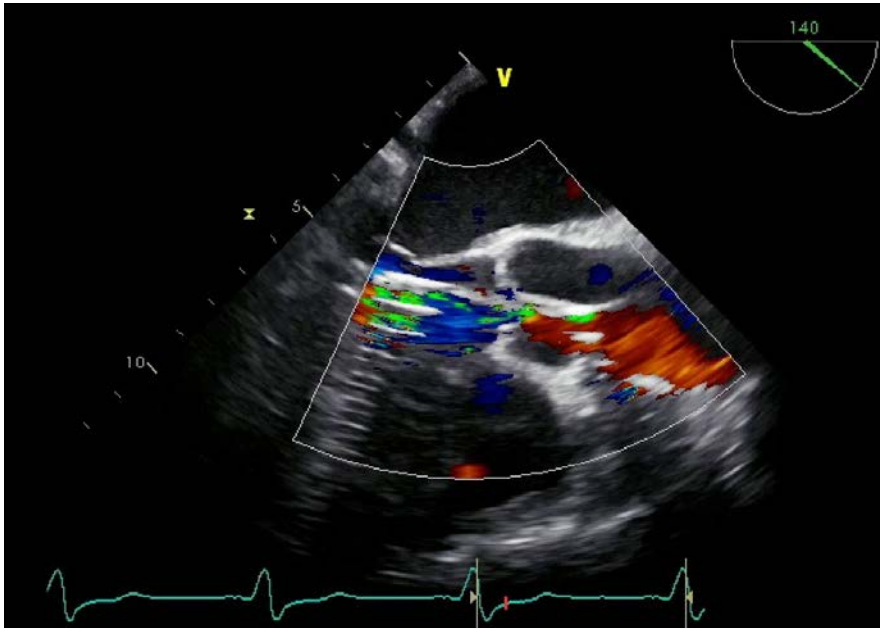
Fallbeispiel 1 Koronare Herzerkrankung



ICM, EF 20%, keine relevanten Klappenvitien

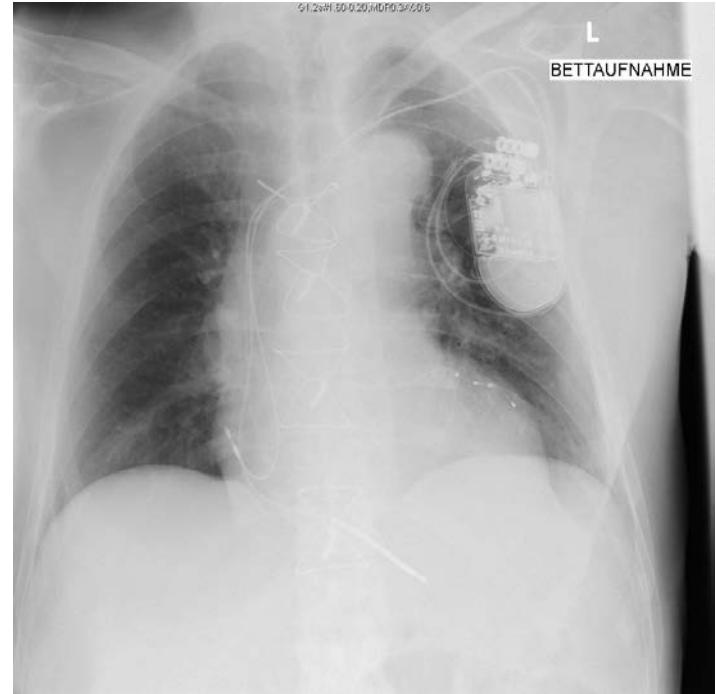
Fallbeispiel 1 Koronare Herzerkrankung

4xOPCAB (LAD, RIM, RMS, RCA)
mit Impella 5.0 über A. axillaris



Fallbeispiel 1 Koronare Herzerkrankung

Zweizeitige Implantation eines CRT-D Systems, EF 30-35%





Fallbeispiel 2 Koronare Herzerkrankung

- Männlich, 57 Jahre
- NSTEMI, ICM EF 20%
- Erstdiagnose einer koronaren Dreifäßerkrankung
- MI II, TI II
- Diabetes Mellitus
- Nikotinabusus
- Schwierige Sozialanamnese (Compliance, Sprachbarriere, kein Telefon)
- EuroScore II: 7,65%

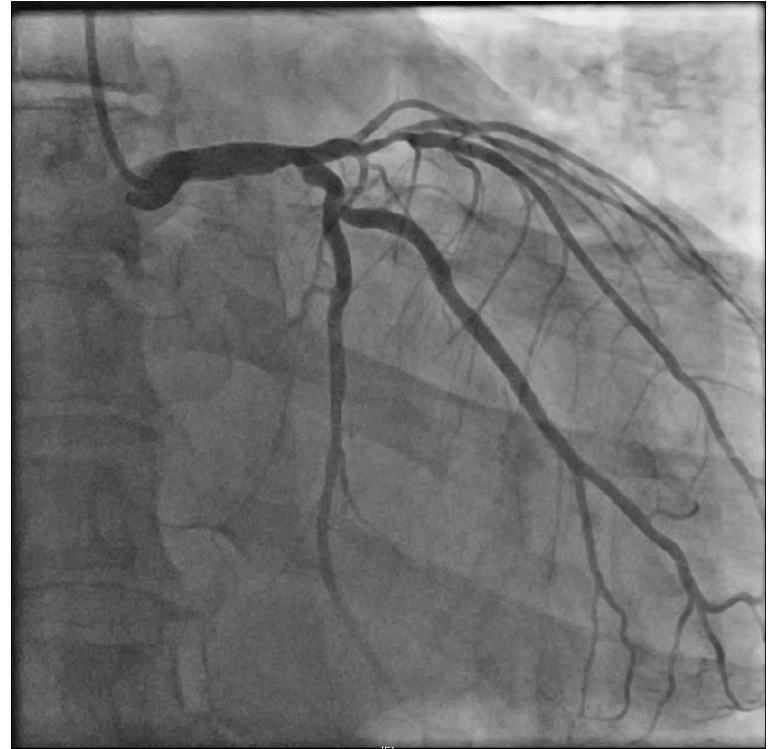
What is new (6)



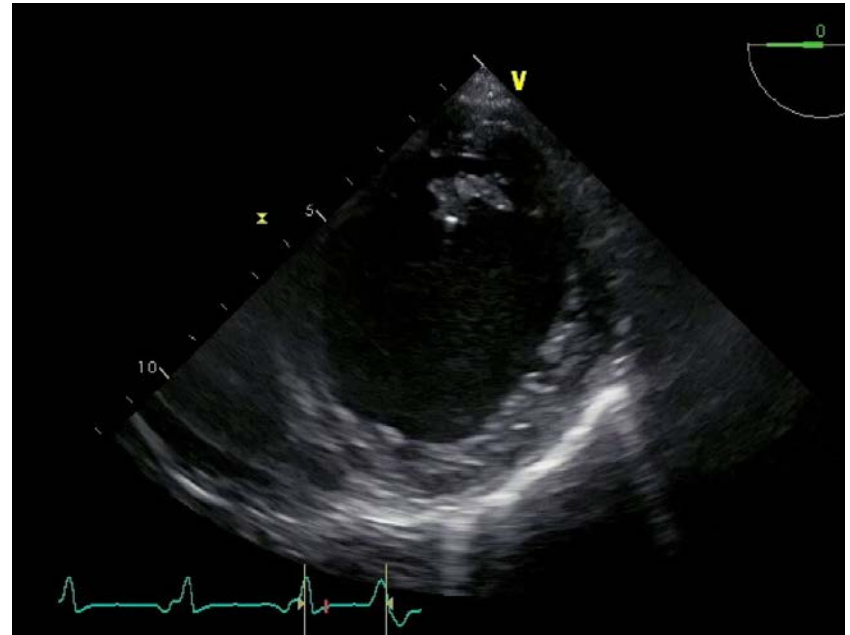
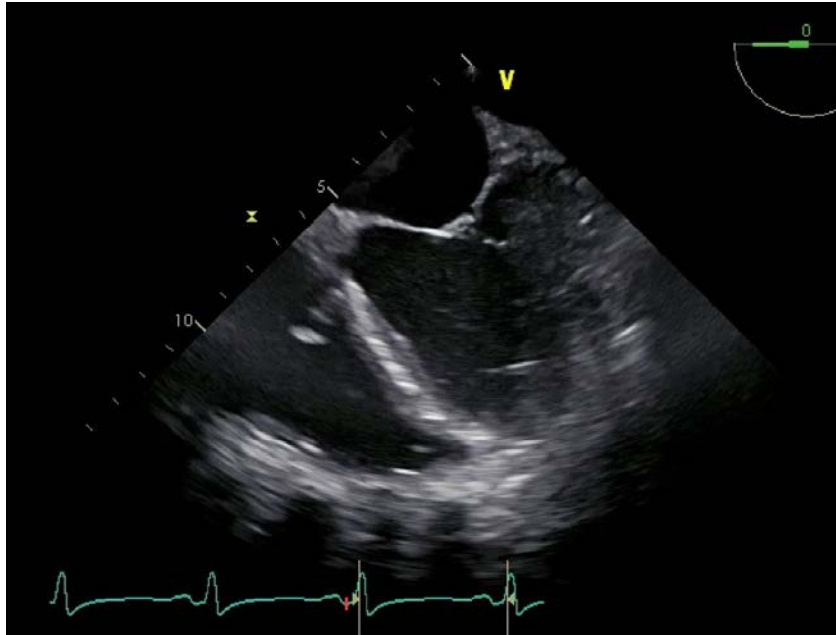
Recommendations for management of patients with HF and CCS	Class
CABG should be considered as the first-choice revascularization strategy, in patients suitable for surgery, especially if they have diabetes and for those with multivessel disease.	IIa
In LVAD candidates needing coronary revascularization, CABG should be avoided, if possible.	IIa
Coronary revascularization may be considered to improve outcomes in patients with HFrEF, CCS, and coronary anatomy suitable for revascularization, after careful evaluation of the individual risk to benefit ratio, including coronary anatomy (i.e. proximal stenosis >90% of large vessels, stenosis of left main or proximal LAD), comorbidities, life expectancy, and patient's perspectives.	IIb
PCI may be considered as alternative to CABG, based on Heart Team evaluation, considering coronary anatomy, comorbidities, and surgical risk.	IIb

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Fallbeispiel 2 Koronare Herzerkrankung



Fallbeispiel 2 Koronare Herzerkrankung



Levosimendan Loading präoperativ

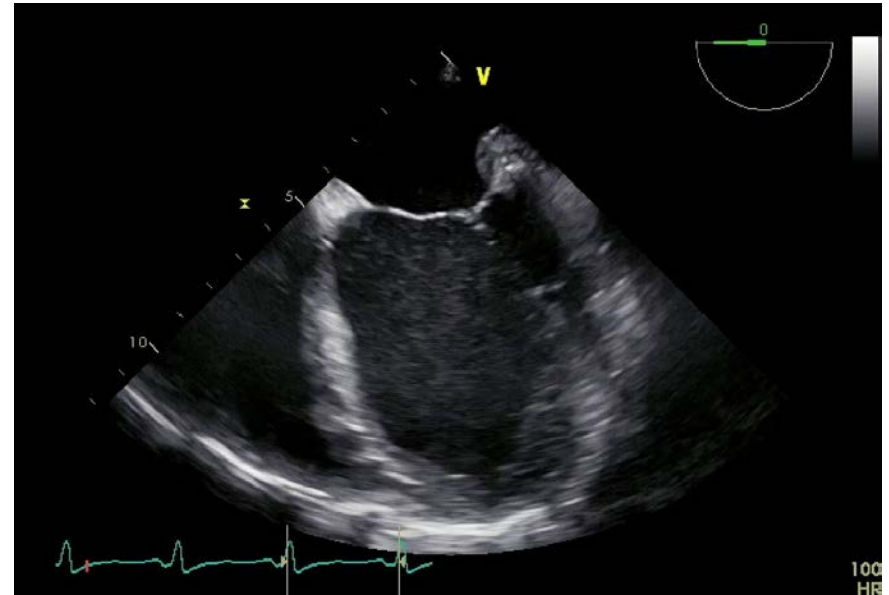
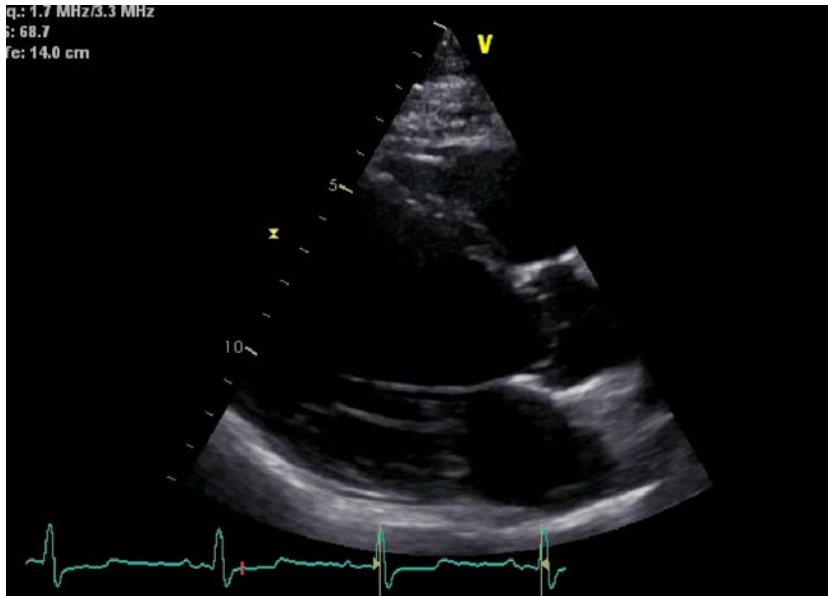


3 x OPCAB (LAD, RMS, RIVP)



Pat. in gutem AZ mit Life-Vest nach Hause entlassen

Fallbeispiel 2 Koronare Herzerkrankung



Weiterhin reduzierte EF 20-25%, Pat. Beschwerdefrei und kompensiert, ICD-Evaluation



Fallbeispiel 3 Aortenklappenvitium

- Männlich, 59 Jahre
- Hochgradige Aortenklappenstenose mit Insuffizienz
Pmax 61 mmHG, Pmean 45 mmHG, AÖF 0.9 cm²
- EF 35%
- Arterielle Hypertonie
- Chronische Niereninsuffizienz
- COPD, Ex-Raucher
- Ausschluss KHK
- EuroScore II: 1,58%

Fallbeispiel 3 Aortenklappenenvitium

What is new (7)



Recommendations for management of patients with HF and aortic valve disease	Class
Aortic valve intervention, TAVI or SAVR is recommended for patients with HF and severe high-gradient aortic stenosis to reduce mortality and improve symptoms.	I
It is recommended that the choice between TAVI and SAVR be made by the Heart Team, according to individual patient preference and clinical factors including age, surgical risk, clinical, anatomical and procedural aspects, and the risks and benefits of each approach.	I
Percutaneous edge-to-edge mitral repair should be considered in carefully selected patients with secondary mitral regurgitation, not eligible for surgery and not needing coronary revascularization, who are highly symptomatic despite OMT and who fulfil criteria to achieve a reduction in HF hospitalizations.	IIa
Percutaneous edge-to-edge mitral valve repair may be considered to improve symptoms in carefully selected patients with secondary mitral regurgitation, not eligible for surgery and not needing coronary revascularization, who are highly symptomatic despite OMT and who do not fulfil criteria for reducing HF hospitalization.	IIb

Heart Team Approach!

Fallbeispiel 3 Aortenklappenenvitium

What is new (9)

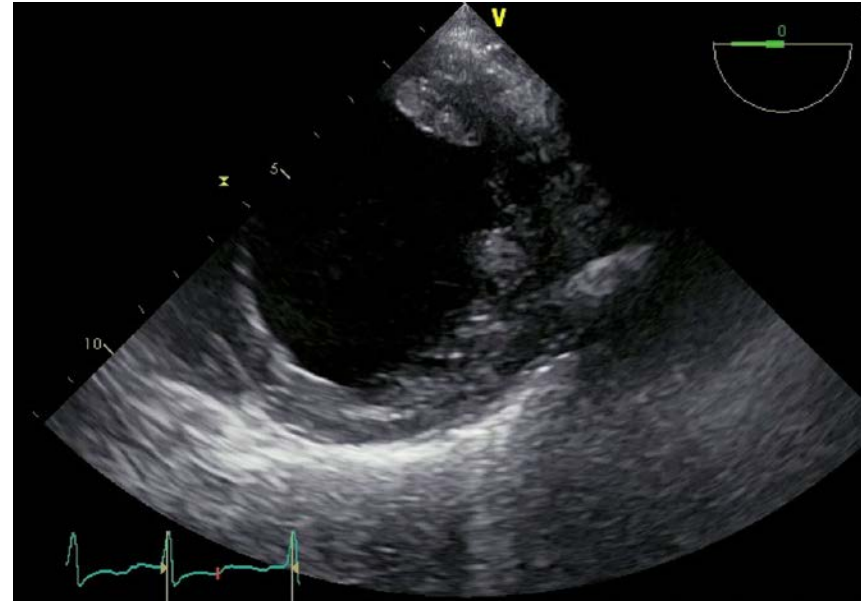
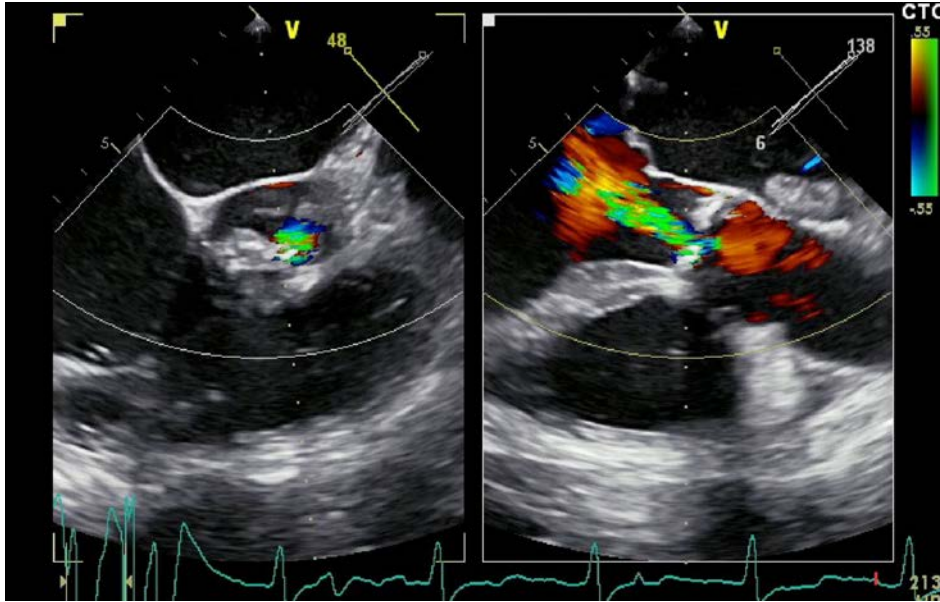


<i>Recommended mode of intervention in patients with aortic stenosis</i>			
2017 VHD Guidelines	Class	2021 VHD Guidelines	Class
SAVR is recommended in patients at low surgical risk (STS or EuroSCORE II <4% or logistic EuroSCORE I <10%, and no other risk factors not included in these scores, such as frailty, porcelain aorta, sequelae of chest radiation).	I	SAVR is recommended in younger patients who are low risk for surgery (<75 years and STS-PROM/ EuroSCORE II <4%) or in patients who are operable and unsuitable for transfemoral TAVI.	I
TAVI is recommended in patients who are not suitable for SAVR as assessed by the Heart Team.	I	TAVI is recommended in older patients (≥75 years), or in those who are high-risk (STS-PROM/ EuroSCORE II >8%) or unsuitable for surgery.	I

©ESC/EACTS

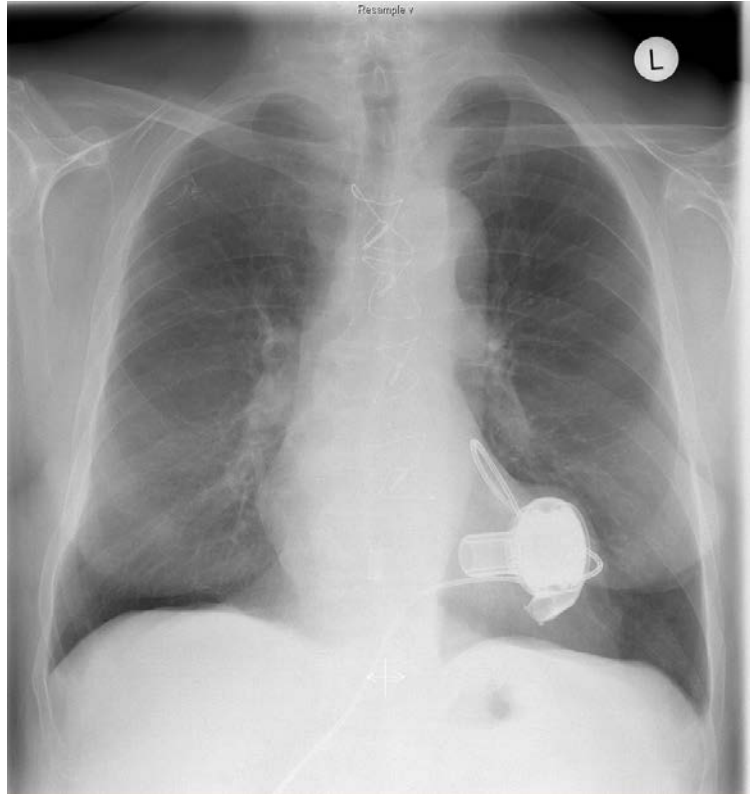
Fallbeispiel 3 Aortenklappenvitium

2018 Aortenklappenersatz



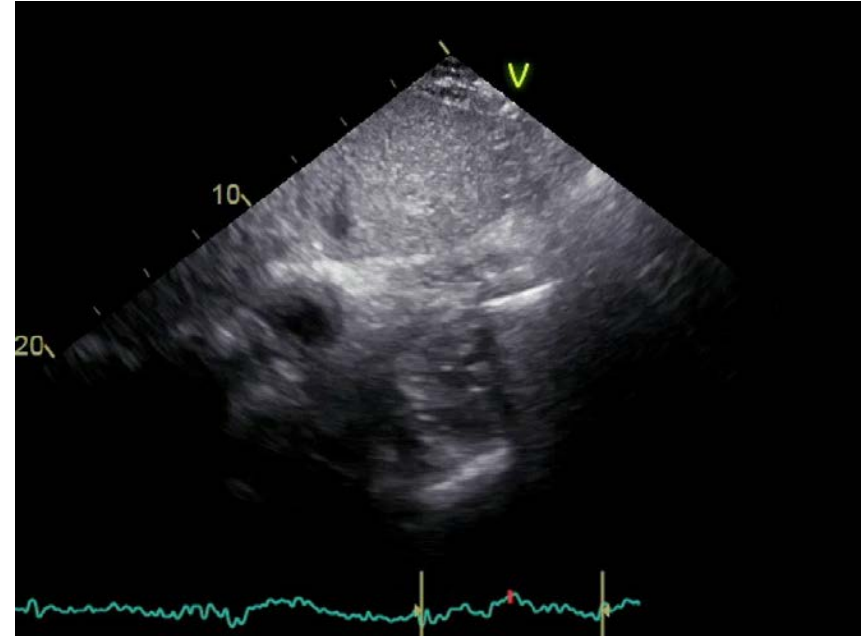
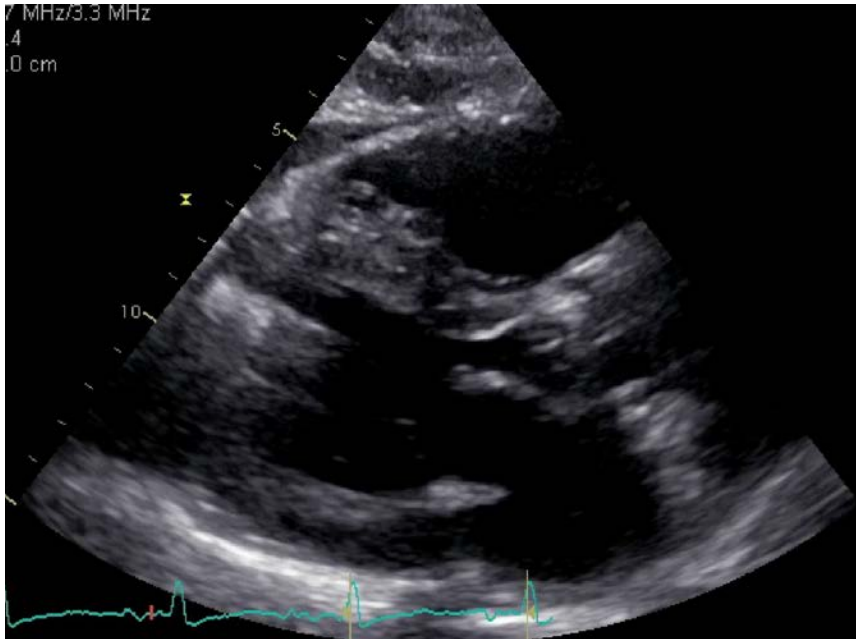
Intraoperativ, EF 10%, Kein HLM-Weaning möglich, ECMO

Fallbeispiel 3 Aortenklappenvitium



Fallbeispiel 3 Aortenklappenenvitium

2020



2 Jahre post AKE+LVAD, Komplettes Reverse Remodeling, EF 65%



Fallbeispiel 4 Mitralklappenenvitium

- Weiblich, 63 Jahre
- DCM EF 35%, Hochgradige Mitralinsuffizienz
- Z.n. CRT-Implant 2013
- Paroxysmales VHF
- Z.n. mehrfacher kardialer Dekompensation

Fallbeispiel 4 Mitralklappenvitium

What is new (7)



Recommendations for management of patients with HF and valvular heart disease	Class
Aortic valve intervention, TAVI or SAVR is recommended in patients with HF and severe high-gradient aortic stenosis to reduce mortality and improve symptoms.	I
It is recommended that the choice between TAVI and SAVR be made by the Heart Team, according to individual patient preference and features including age, surgical risk, clinical, anatomical and procedural aspects, weighing the risks and benefits of each approach.	I
Percutaneous edge-to-edge mitral valve repair should be considered in carefully selected patients with secondary mitral regurgitation, not eligible for surgery and not needing coronary revascularization, who are symptomatic despite OMT and who fulfil criteria to achieve a reduction in HF hospitalizations.	IIa
Percutaneous edge-to-edge mitral valve repair may be considered to improve symptoms in carefully selected patients with secondary mitral regurgitation, not eligible for surgery and not needing coronary revascularization, who are highly symptomatic despite OMT and who do not fulfil criteria for reducing HF hospitalization.	IIb

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Fallbeispiel 4 Mitralklappenenvitium

What is new (16)



<i>Indications for mitral valve intervention in chronic severe secondary mitral regurgitation</i>			
2017 VHD Guidelines	Class	2021 VHD Guidelines	Class
<i>Patients without concomitant coronary artery or other cardiac disease requiring treatment</i>			
When revascularization is not indicated and surgical risk is not low, a percutaneous edge-to-edge procedure may be considered in patients with severe secondary mitral regurgitation and LVEF >30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have a suitable valve morphology by echocardiography, avoiding futility.	IIb	TEER should be considered in selected symptomatic patients, not eligible for surgery and fulfilling criteria suggesting an increased chance of responding to the therapy.	IIa

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Fallbeispiel 4 Mitralklappenenvitium

What is new (17)

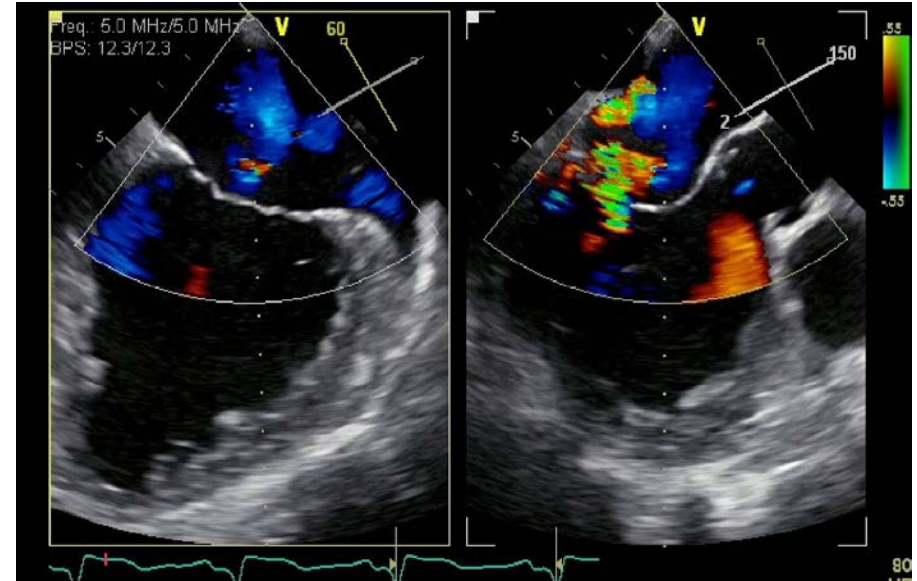
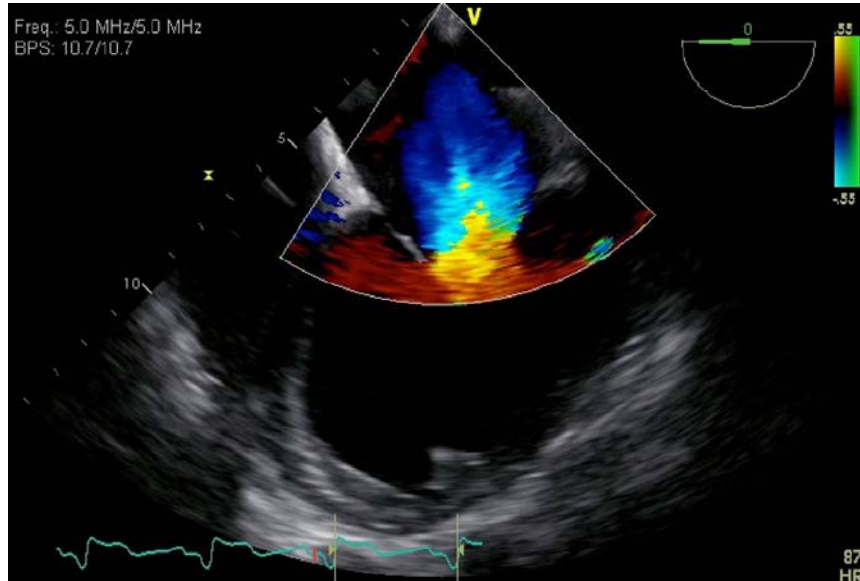


<i>Indications for mitral valve intervention in chronic severe secondary mitral regurgitation</i>			
2017 VHD Guidelines	Class	2021 VHD Guidelines	Class
<i>Patients without concomitant coronary artery or other cardiac disease requiring treatment</i>			
In patients with severe SMR and LVEF <30% who remain symptomatic despite optimal medical management (including CRT if indicated) and who have no option for revascularization, the Heart Team may consider a percutaneous edge-to-edge procedure or valve surgery after careful evaluation for a ventricular assist device or heart transplant according to individual patient characteristics.	IIb	In high-risk symptomatic patients not eligible for surgery and not fulfilling the criteria suggesting an increased chance of responding to TEER, the Heart Team may consider in selected cases a TEER procedure or other transcatheter valve therapy if applicable, after careful evaluation for ventricular assist device or heart transplant.	IIb

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Fallbeispiel 4 Mitralklappenenvitium

2015

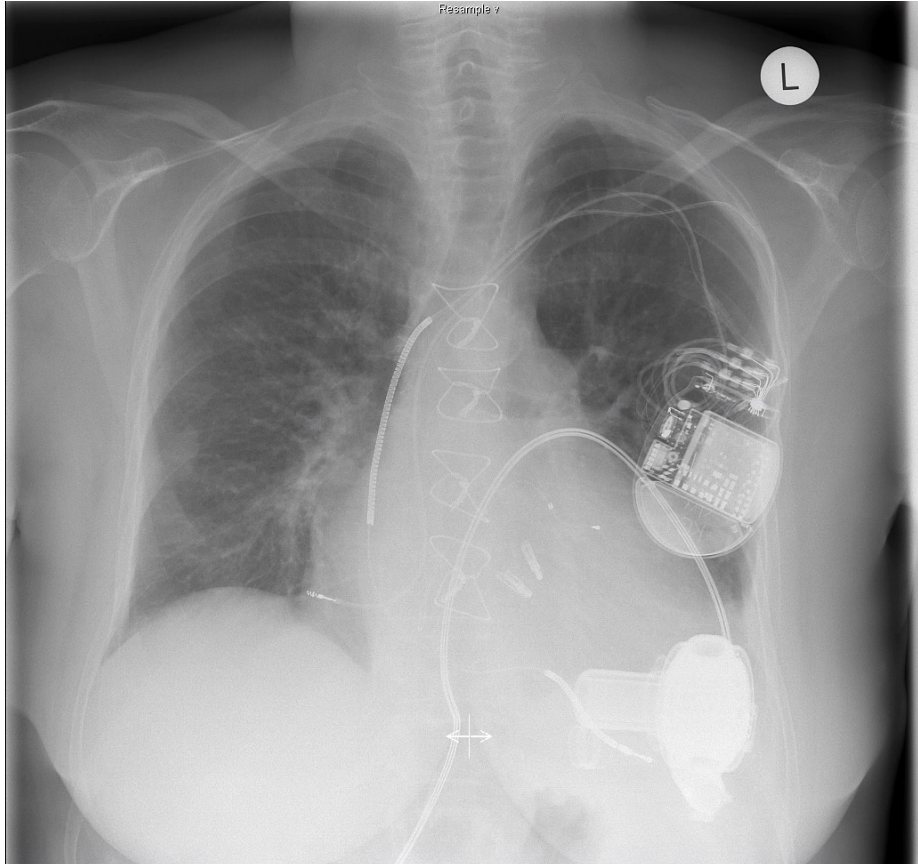


Hochgradige Mitralklappeninsuffizienz, EF 35%

Fallbeispiel 4 Mitralklappenenvitium



Fallbeispiel 4 Mitralklappenenvitium



Pat. im Follow-Up in klinisch
sehr gutem Zustand mit
subjektiv guter Lebensqualität



European Journal of Heart Failure (2018) 20, 152–160
doi:10.1002/ehf.975

RESEARCH ARTICLE

Screening for heart transplantation and left ventricular assist system: results from the ScrEEning for advanced Heart Failure treatment (SEE-HF) study

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Patients with CRT and/or ICD + NYHA III-IV + EF<40%

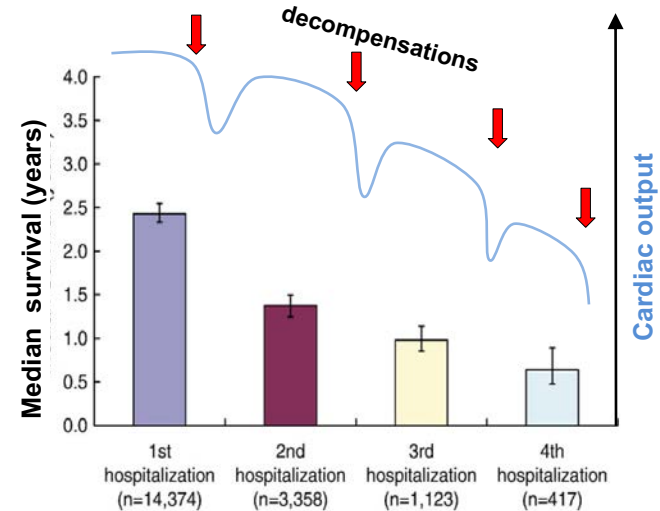
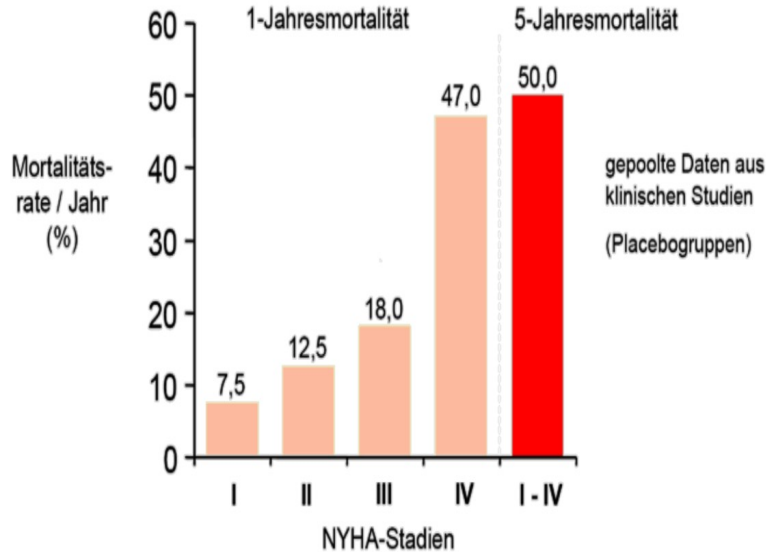
➤ Among these, more than one quarter have an unrecognized need for HTX or LVAD

Klinische Zeichen die zu einer LVAD-Evaluation führen sollten:

- Hospitalisation innerhalb von 6 Monaten ohne reversiblen Grund
- End-Organ Dysfunktion (meist renal, aber auch hepatisch und cerebral)
- Intoleranz gegenüber ACE-Inh., Sartan, Betablocker, etc. (Hypotension)
- Hoch-Dosis Diuretika
- Rhythmusstörungen / Defibrillatorschocks
- Inotropikabedarf
- Verschlechterung der RH-Funktion

Zeitpunkt der LVAD Implantation

Hospitalizations because of heart failure reduce the lifetime

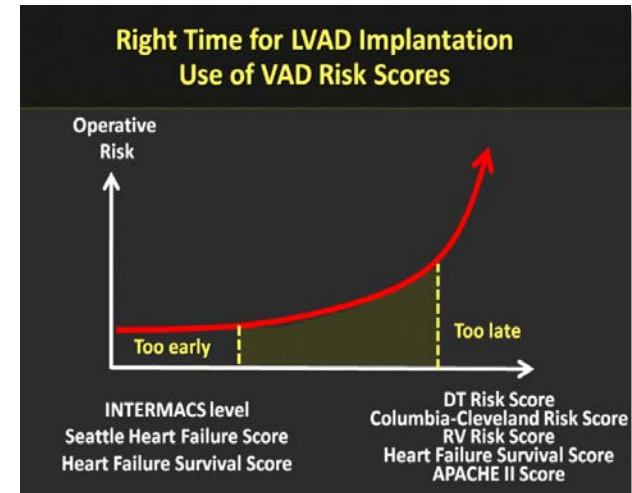


Massie BM, Am Heart J 1997; 133: 703–712
Boyko WL, AM Heart J 1999; 137: 115–119

Modified from:
Gheorghiad et al, Am J Cardiol 2005
Setoguchi S et al, Am Heart J 2007

Zeitpunkt der LVAD Implantation

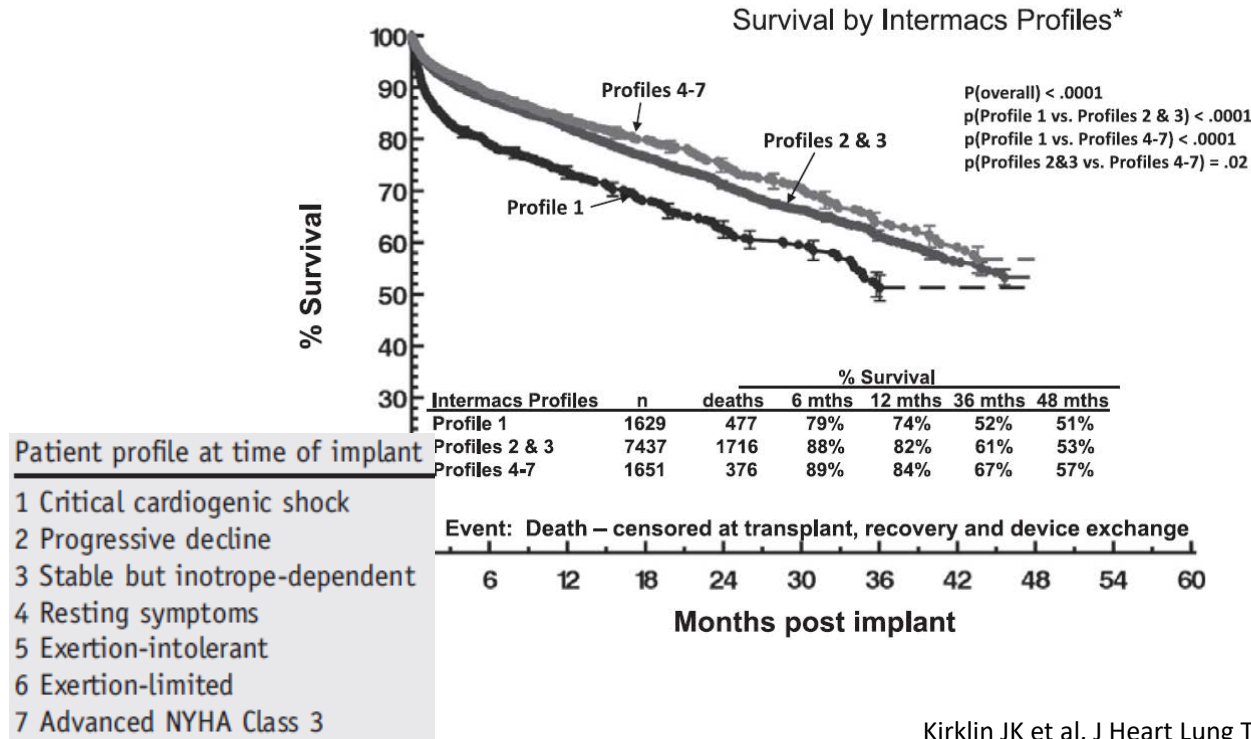
INTERMACS level	NYHA Class	Description	Device	1y survival with LVAD therapy
1. Cardiogenic shock "Crash and burn"	IV	Haemodynamic instability in spite of increasing doses of catecholamines and/or mechanical circulatory support with critical hypoperfusion of target organs (severe cardiogenic shock).	ECLS,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



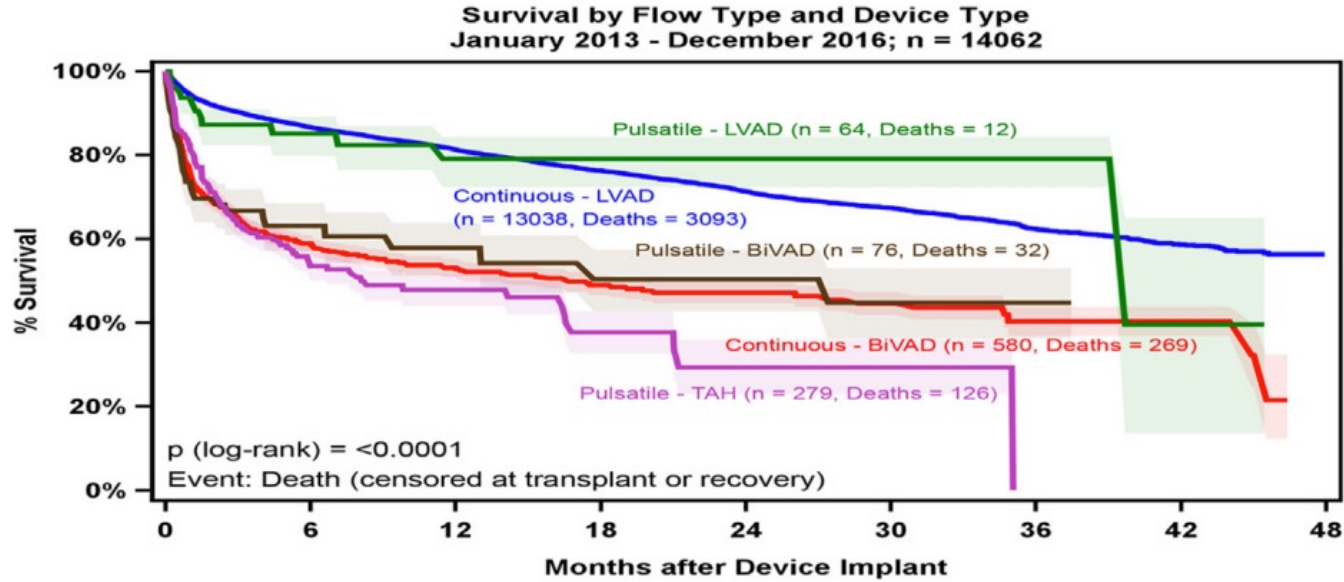
Katherine Lietz, 2008

Zeitpunkt der LVAD Implantation

Intermacs Continuous Flow LVAD/BiVAD Implants: 2013 – 2016, n= 10,726

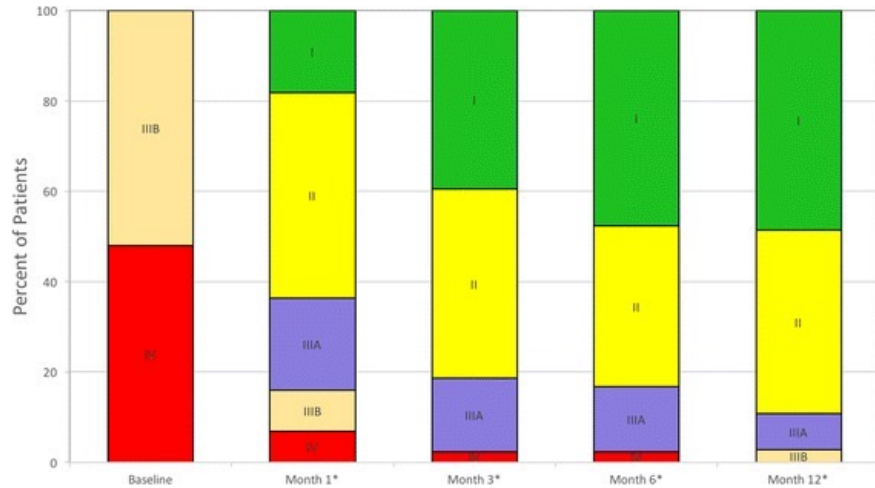


Survival

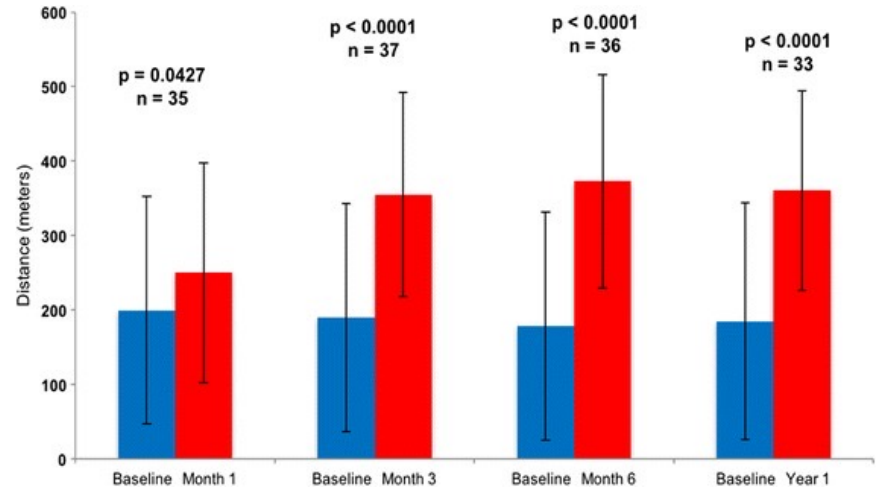


Months	Continuous LVAD	Continuous BiVAD	Pulsatile LVAD	Pulsatile BiVAD	Pulsatile TAH
1	94.5%	76.1%	93.7%	73.6%	82.4%
6	86.6%	58.9%	85.1%	63.1%	53.5%
12	81.3%	53.1%	79.1%	57.8%	47.8%
24	71.3%	47.1%	79.1%	50.3%	29.3%
36	62.4%	40.3%	79.1%	44.7%	

NYHA-Stadium



6-min Gehtest



Recommendations for telemonitoring

Recommendations	Class ^a	Level ^b
Non-invasive HTM may be considered for patients with HF in order to reduce the risk of recurrent CV and HF hospitalizations and CV death. ³⁷⁴	IIb	B
Monitoring of pulmonary artery pressure using a wireless haemodynamic monitoring system may be considered in symptomatic patients with HFrEF (LVEF ≤35%) in order to improve clinical outcomes. ³⁷²	IIb	B

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CV = cardiovascular; HF = heart failure; HFrEF = heart failure with reduced ejection fraction; HTM = home telemonitoring; LVEF = left ventricular ejection fraction.

^aClass of recommendation.

^bLevel of evidence.





Vielen Dank!

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