STS/EACTS Latin America Cardiovascular Surgery Conference

November 15-17, 2018

Hilton Cartagena | Cartagena, Colombia

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ECMO as a Bridge to Heart Transplant in the Era of LVAD's.

Conflict of Interest.

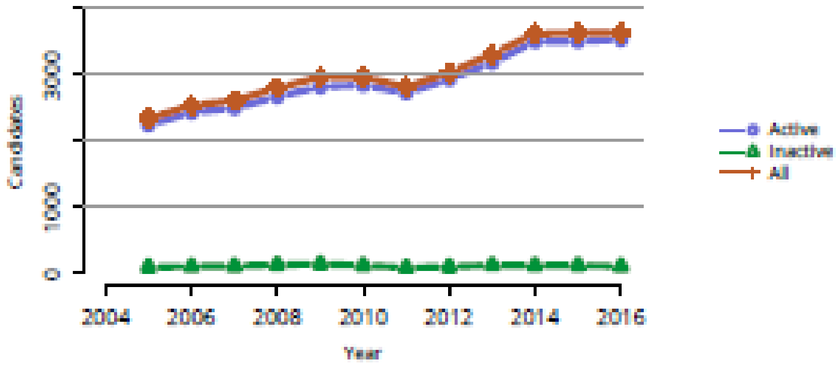
- No financial disclosures.
- I will discussed the off-label use of ECMO systems.

Objective

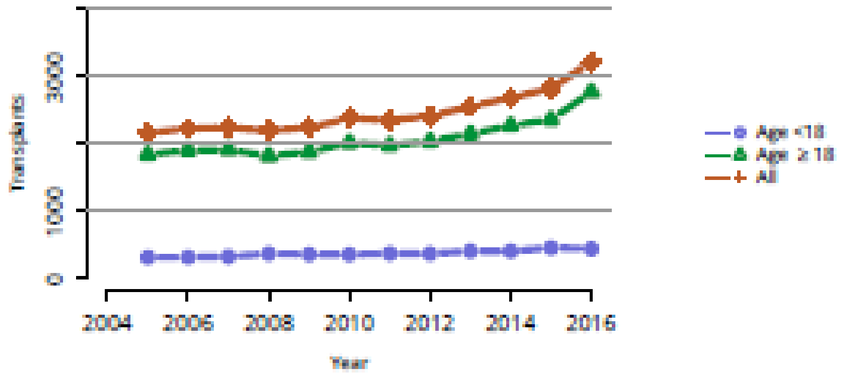
- To discuss recently implemented changes regarding the use of temporary MCS (ECMO) as a bridge to HTX in the US.
- To assess US and International experience with the use of ECMO previous to heart transplant.
- To discuss implications and patient selection

Heart Transplants in the US

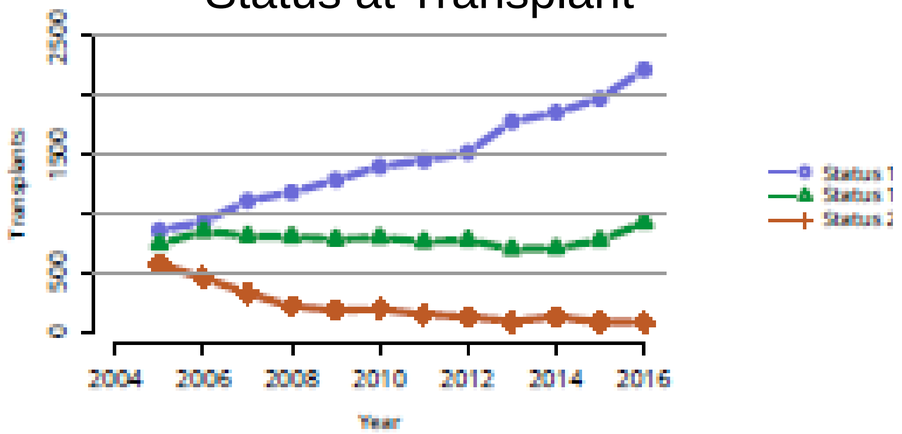
Candidates



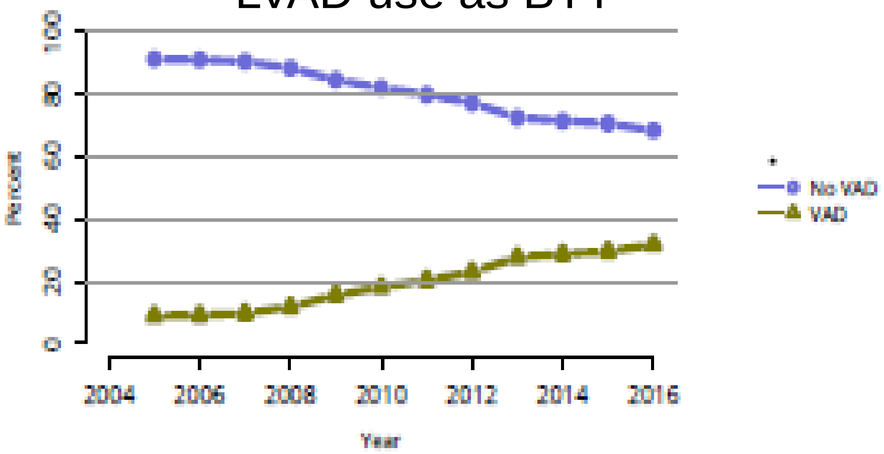
Transplants



Status at Transplant



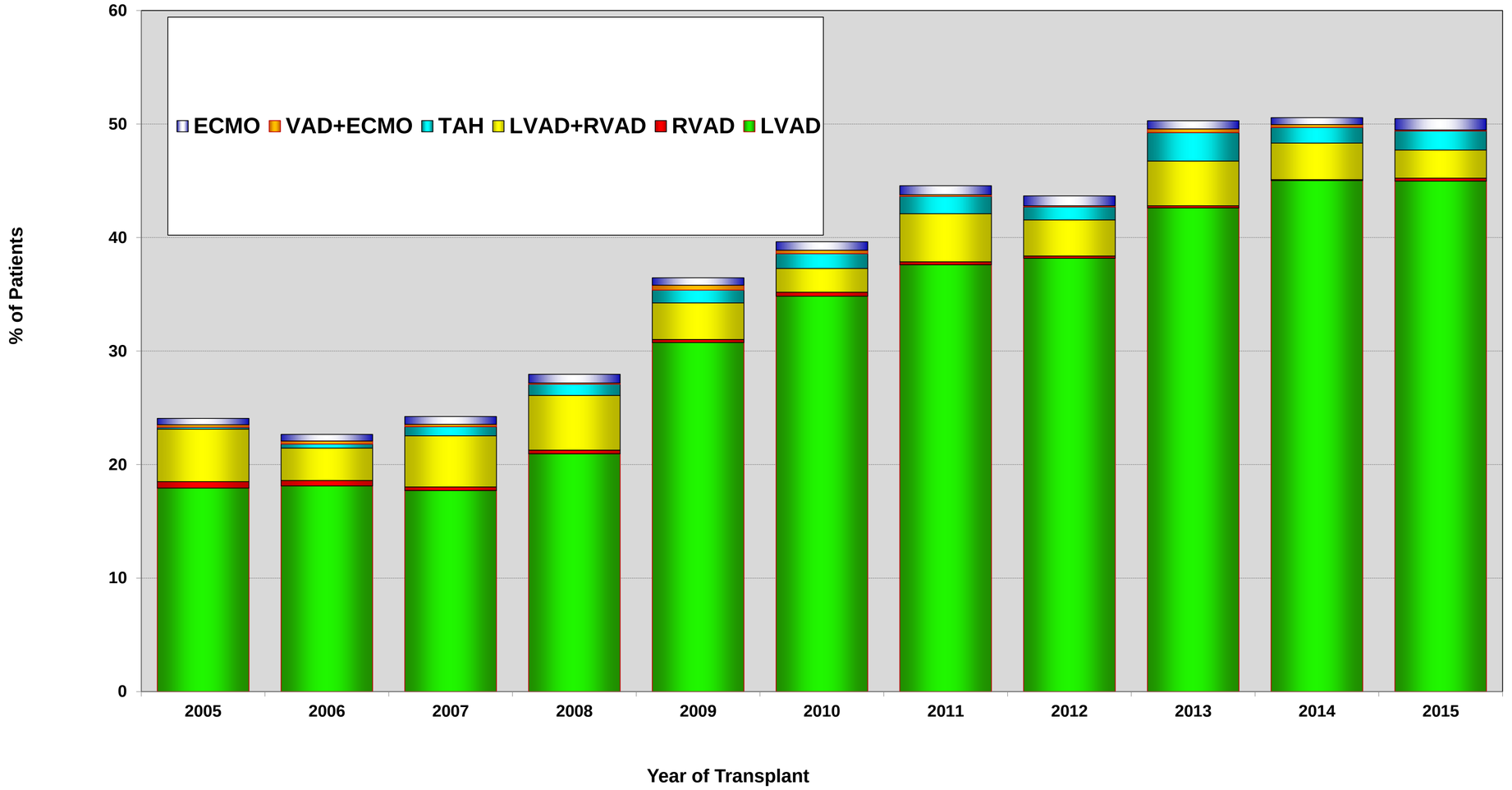
LVAD use as BTT



OPTN/SRTR 2016 Annual Data Report: Heart

AJT 2018 18:S1, 1-503

Adult Heart Transplants: Patients Bridged with Mechanical Circulatory Support by Year and Device Type

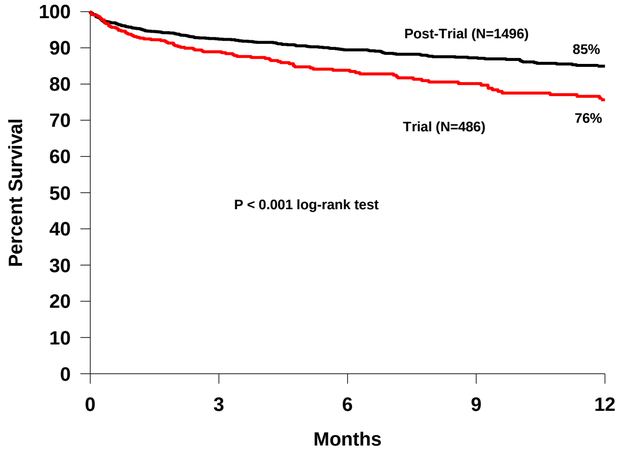


* LVAD, RVAD, TAH, ECMO

ISHLT • INTERNATIONAL SOCIETY FOR HEART AND LUNG TRANSPLANTATION

Contemporary LVAD and Outcomes

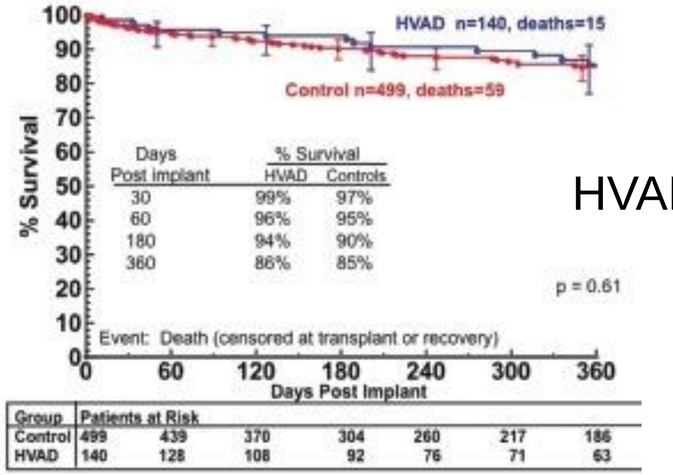
Bridge to Transplant



HMII

Ann Thorac Surg 2011;92:1406-13

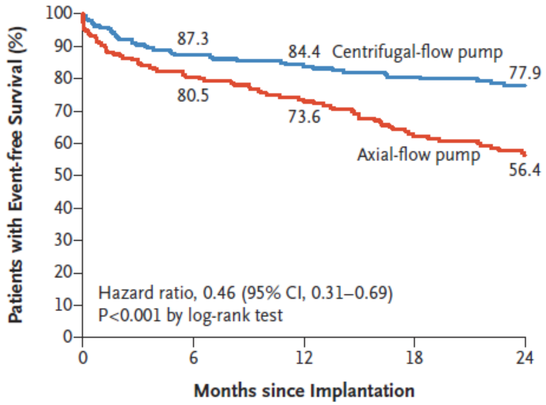
Bridge to Transplant



HVAD

Circulation 2012;125:3191-3200

Bridge to Transplant and DT

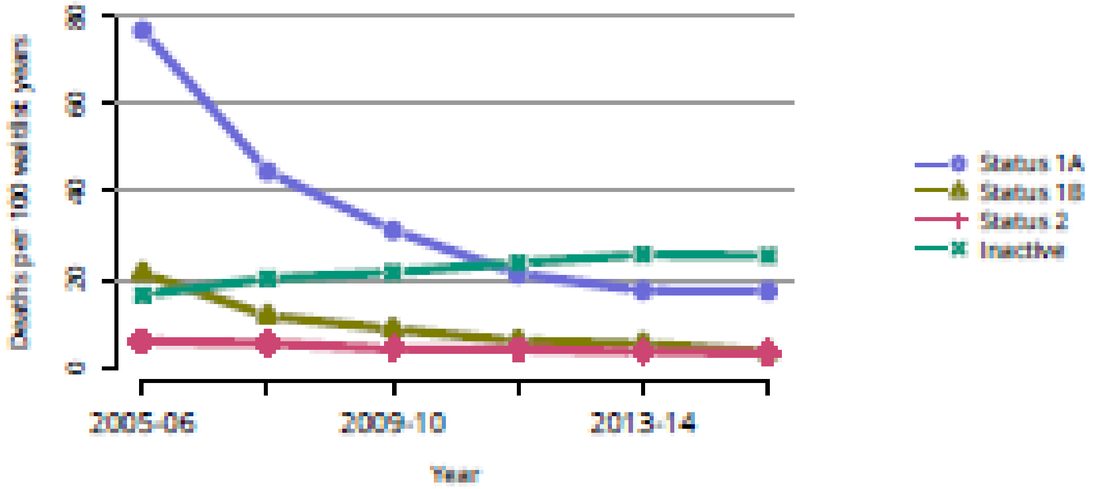


No. at Risk					
Centrifugal-flow pump	190	161	141	122	111
Axial-flow pump	176	134	114	90	75

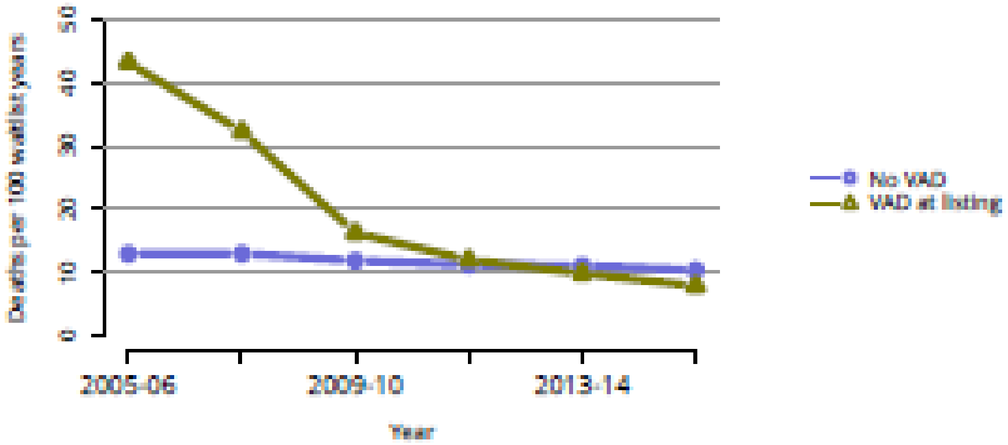
HM3

n engl j med 378;15 nejm.org April 12, 2018

OPTN/SRTR 2016 Annual Data Report: Heart



- Pretransplant mortality declined precipitously among status 1A and 1B candidates



- Pretransplant mortality declined notably for candidates with VADs at listing, from 43.2 to 8.0 deaths per 100 waitlist years, lower than the pretransplant mortality among candidates without VADs

AJT 2018 18:S1, 1-503

Listing for Heart Transplant: Status System

Status 1A: The sickest patient, time limited

- Mechanical Support**- ECMO**, Balloon pump, mechanical ventilator
- High dose IV inotrope medication and Swan-Ganz catheter
- VAD ventricular assist device (30 days of 1A time)
- VAD > 30 days with complication (thrombus, infection, malfunction, life-threatening ventricular rhythms)
- UNOS Review Board petition for exception

Status 1B: Mid level patient, not time limited

- VAD, TAH patient at home
- Continuous IV inotrope
- UNOS Review Board petition for exception

Status 2: Stable but sick patient

- Heart failure patient managed on oral medications

Status 7: Inactive patient, no time accrues during this phase

- Temporarily unsuitable to receive transplant

Transplant Registrants With Implanted LVAD Have Insufficient Risk to Justify Elective Organ Procurement and Transplantation Network Status 1A Time

Todd Dardas, MD, MS,* Nahush A. Mokadam, MD,† Francis Pagani, MD, PHD,‡
Keith Aaronson, MD, MS, § Wayne C. Levy, MD*

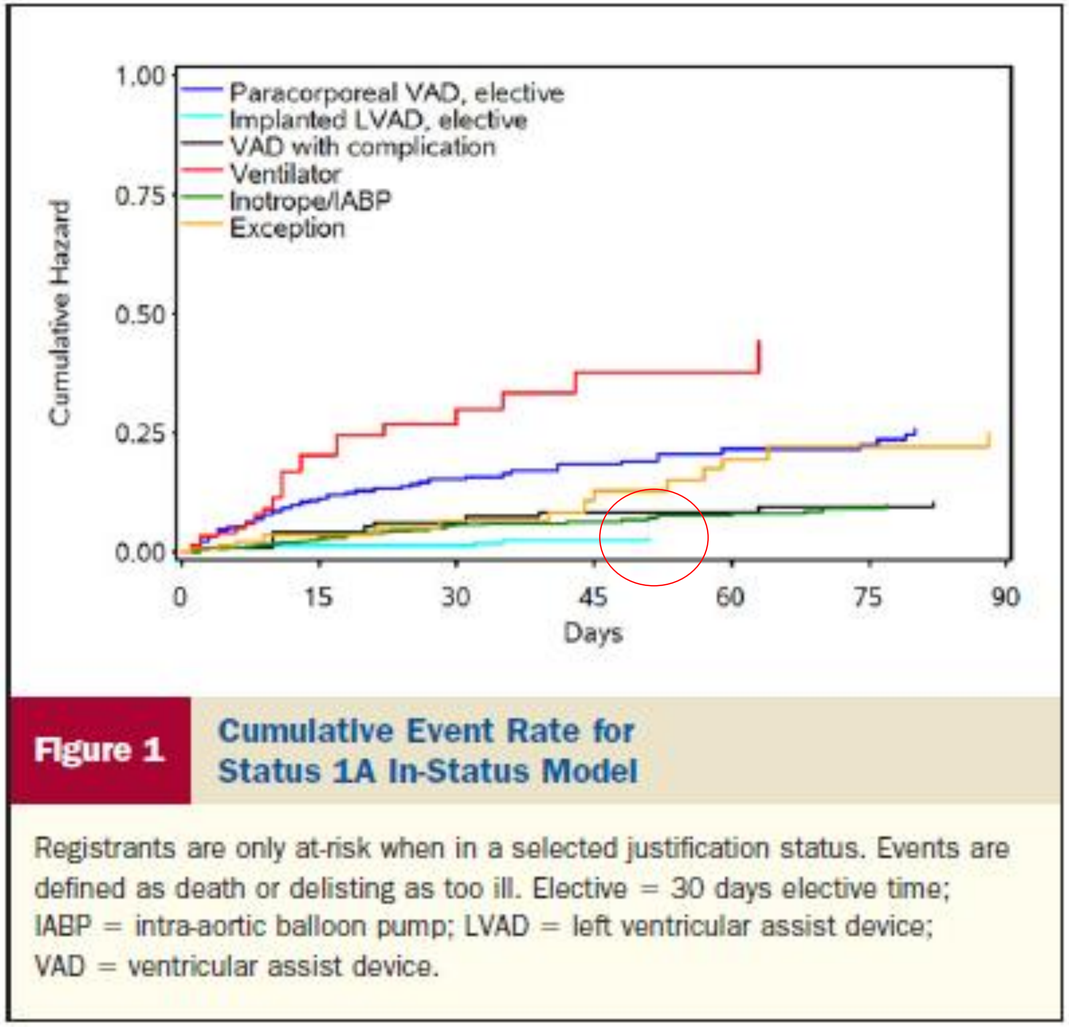


Figure 1 **Cumulative Event Rate for Status 1A In-Status Model**

Registrants are only at-risk when in a selected justification status. Events are defined as death or delisting as too ill. Elective = 30 days elective time; IABP = intra-aortic balloon pump; LVAD = left ventricular assist device; VAD = ventricular assist device.

- The historic allowance for 30 days of elective status 1A time for implanted LVADs creates disparities in risk among status 1A registrants.
- The allowance of 30 days of elective status 1A time should not be allocated to stable registrants with implanted LVADs.
- Registrants supported with paracorporeal ventricular assist devices should be listed status 1A indefinitely.

J Am Coll Cardiol 2012;60:36–43

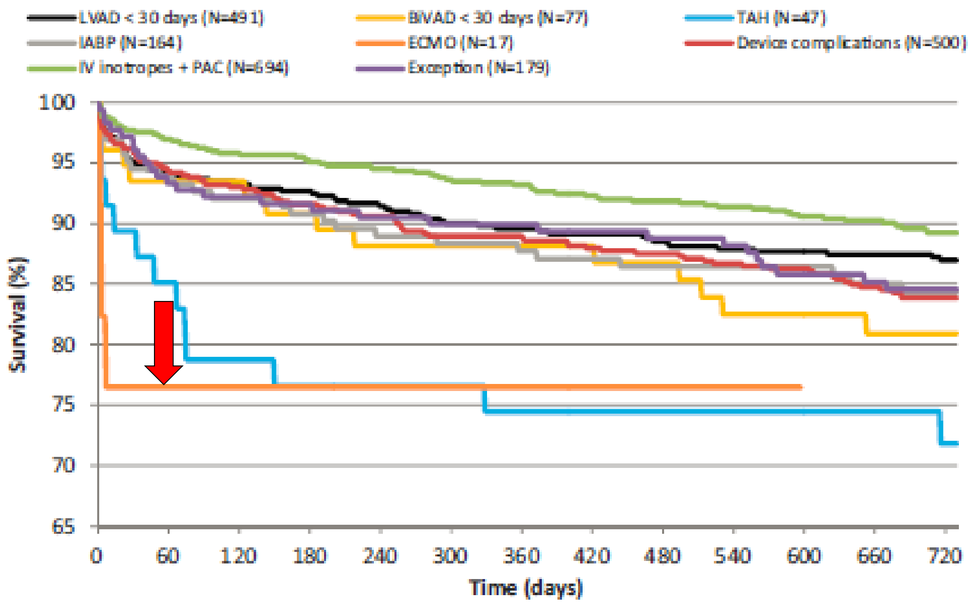
The Future Direction of the Adult Heart Allocation System in the United States

Table 1: All sub-criteria while waiting for those ever Status 1A Criteria A or B

Status 1A criteria	All sub-criteria while waiting	Waiting list							Transplant		
		# listed (2010-2011)	Prob. of TX			Prob. of Death			# TXed (2010-2011)	Prob. of death	
			1 month+	6 months +	12 months +	1 month+	6 months +	12 months +		6 months	12 months
A	(i)	1,169	37.2%	63.3%	72.5%	3.0%	5.1%	5.7%	1,138	8.09%	10.90%
	(ii)	58	20.7%	70.7%	*	3.5%	8.6%	*	46	21.74%	23.91%
	(iii)	452	31.9%	52.7%	60.6%	10.2%	15.5%	16.6%	344	8.14%	11.43%
	(iv)	70	24.3%	31.4%	*	35.7%	35.7%	*	25	24.00%	24.00%
B	(i)	113	38.1%	70.8%	75.2%	1.8%	6.2%	7.1%	93	6.5%	6.50%
	(ii)	228	21.5%	67.1%	76.3%	0.9%	4.8%	6.1%	262	8.02%	11.90%
	(iii)	80	21.2%	55.0%	65.0%	7.5%	11.2%	12.5%	80	8.75%	10.04%
	(iv)	28	14.3%	57.1%	*	10.7%	10.7%	*	28	14.29%	14.29%
	(v)	83	26.5%	63.9%	67.5%	1.2%	10.8%	10.8%	93	7.53%	10.90%

Sub-criteria:
A(i)=VAD for 30 days
A(ii)=total artificial heart
A(iii)-Intra-aortic balloon pump (IABP)
A(iv)=ECMO

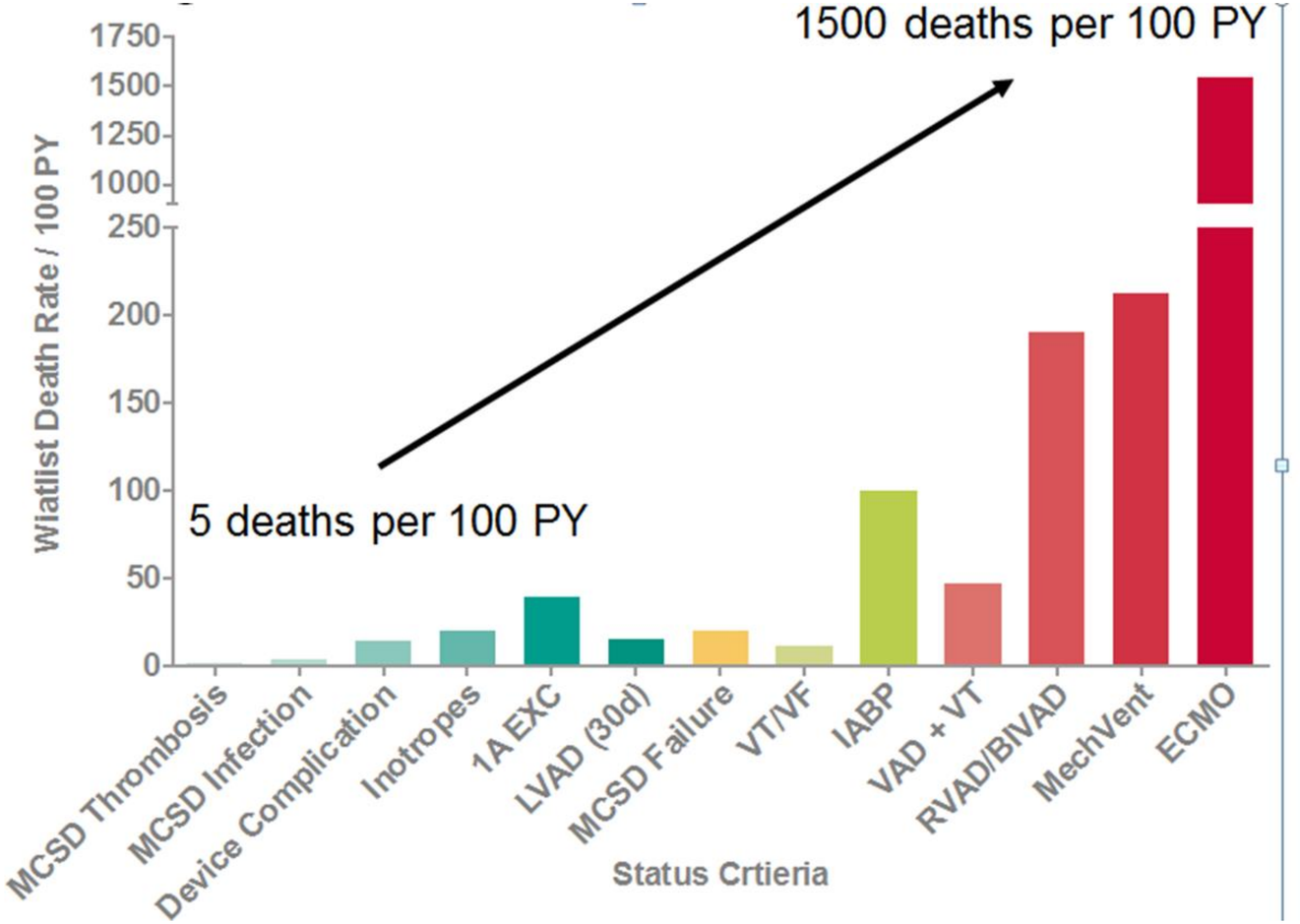
B(i)=MCSD with Thromboembolism
B(ii)=MCSD with infection
B(iii)=MCSD with malfunction
B(iv)=MCSD with life-threatening ventricular arrhythmia
B(v)=MCSD with other complication



American Journal of Transplantation 2015; 15: 44–54

Why was change thought to be necessary?

- Disparate urgency risk with Status 1A



New Six-Tier Adult Allocation System

Status 1	VA ECMO Non-dischargeable surgically implanted, non-endovascular biventricular support device MCSD with life-threatening ventricular arrhythmia
Status 2	• Non-dischargeable, surgically implanted, non-endovascular LVAD • IABP V-tach / V-fib, mechanical support not required MCSD with device malfunction/mechanical failure TAH, BiVAD, RVAD, or VAD for single ventricle patients • Percutaneous endovascular MCSD
Status 3	• Dischargeable LVAD for discretionary 30 days • Multiple inotropes or single high-dose inotrope with continuous hemodynamic monitoring • VA ECMO after 7 days; percutaneous endovascular circulatory support device or IABP after 14 days Non-dischargeable, surgically implanted, non-endovascular LVAD after 14 days MCSD with one of the following: • device infection, hemolysis, pump thrombosis, right heart failure, mucosal bleeding, aortic insufficiency
Status 4	• Dischargeable LVAD without discretionary 30 days Inotropes without hemodynamic monitoring Retransplant Diagnosis of one of the following: congenital heart disease (CHD), ischemic heart disease with intractable angina, hypertrophic cardiomyopathy, restrictive cardiomyopathy, amyloidosis
Status 5	On the waitlist for at least one other organ at the same hospital
Status 6	All remaining active candidates

New Heart Allocation System Nuances

Status 1

- **VA ECMO**
- **Non-dischargeable surgically implanted, non-endovacular biventricular support device**
- **MCSD with life-threatening ventricular arrhythmia**

Hemodynamic Criteria for Status 1 for ECMO	
Initial	Within 7 days prior to VA ECMO support, **all** of the following are true within one 24 hour period: • SBP < 90 mmHg • CI < 1.8 L/min/m2 if not on inotropes or < 2.0 L/min/m2 if on at least one inotrope • PCWP >15 mmHg If hemodynamic measurements could not be obtained within 7 days prior to VA ECMO support, **at least one of the following** is true within 24 hours prior to VA ECMO support: • CPR was performed on the candidate • SBP < 70 mmHg • Arterial lactate > 4 mmol/L • AST or ALT >1,000 U/L
After 7 days	Candidate continues to be supported by ECMO with a contraindication to durable device and **at least one** of the following: • MAP <60 mmHg • CI < 2.0 L/min/m2 • PCWP >15 mmHg • SvO2 < 50 % measured by central venous catheter

- Good initially for 7 days
- After initial 7 days, patient would still need to meet criteria for extending Status 1

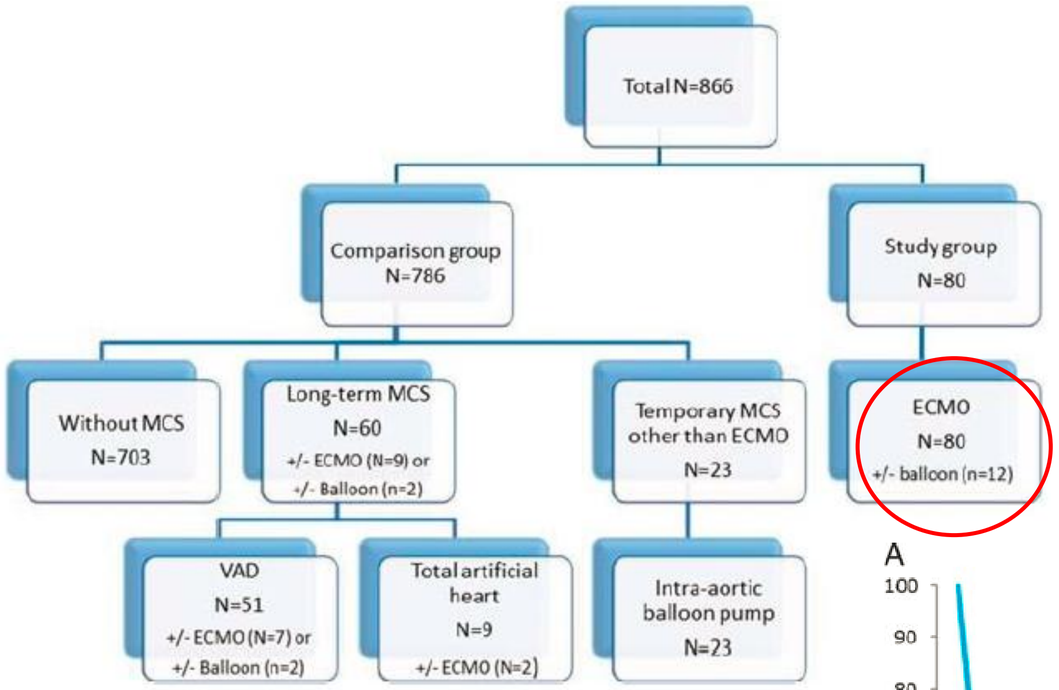
Heart Failure Specialist reaction following new Heart Allocation Proposal

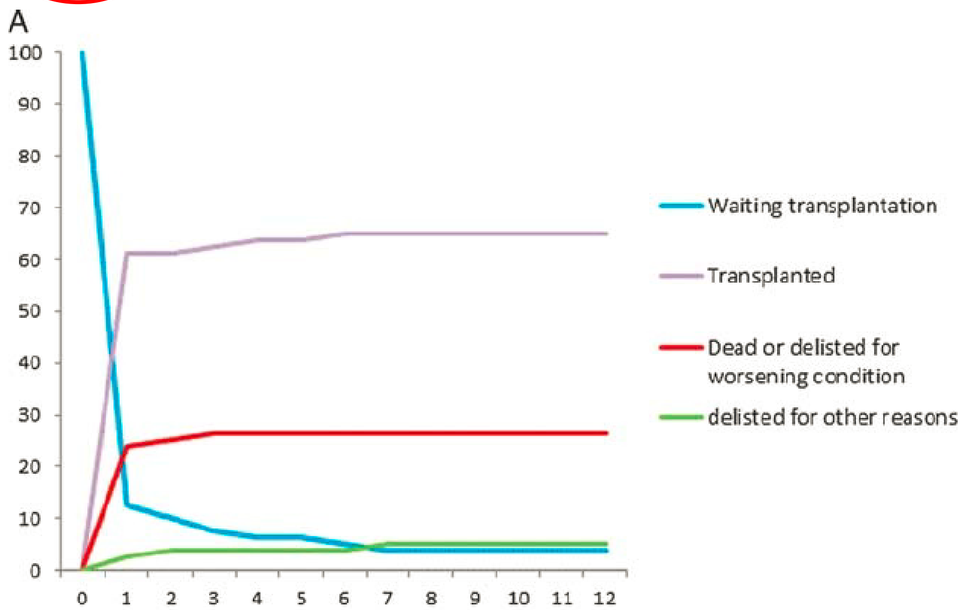
ECMO as a Bridge to Heart Transplant

What does the international experience show?

What is the US experience?

Impact of Heart Transplantation on Survival in Patients on VA ECMO at Listing in France

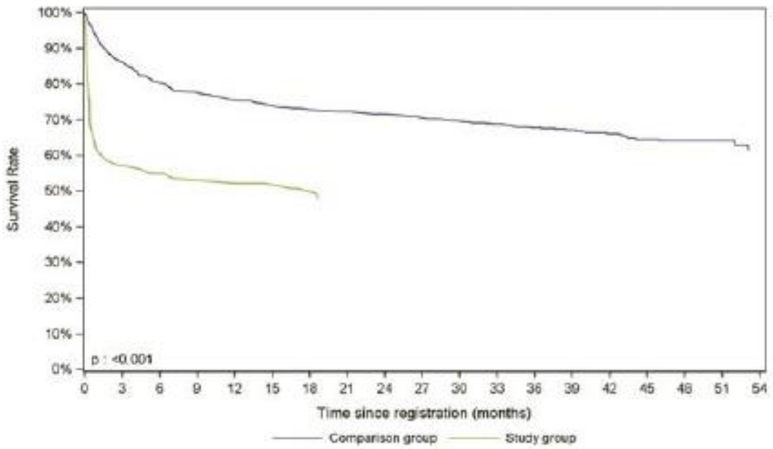




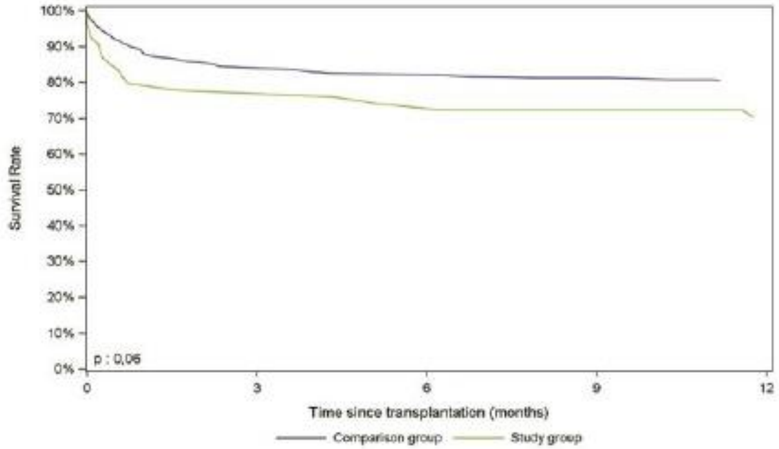
Transplantation 2016;100: 1979–1987

Impact of Heart Transplantation on Survival in Patients on VA ECMO at Listing in France

KM SV All ECMO vs No ECMO



KM SV ECMO transplanted



Group	N	1-month Survival	3-month Survival	1-year Survival
Comparison group	786	93,1% [91,1% - 94,7%]	86,4% [83,8% - 88,6%]	75,5% [72,4% - 78,4%]
Number of patients at risk*		732	676	579
Study group	80	61,6% [49,8% - 71,4%]	57,6% [45,8% - 67,7%]	52,2% [40,5% - 62,6%]
Number of patients at risk*		47	43	38

Group	N	1-month Survival	3-month Survival	1-year Survival
Comparison group	617	88,3% [85,5% - 90,6%]	84,3% [81,2% - 87,0%]	80,7% [77,3% - 83,6%]
Number of patients at risk*		535	510	483
Study group	55	79,7% [66,3% - 88,2%]	77,8% [64,3% - 86,8%]	70,4% [56,3% - 80,7%]
Number of patients at risk*		43	42	37

Conclusions. Transplantation provides a survival benefit in listed patients on VA-ECMO even if post-transplant survival remains inferior than for patients without VA-ECMO. Transplantation may be considered to be an acceptable primary therapy in selected patients on VA-ECMO.

Transplantation 2016;100: 1979–1987

High-urgency waiting list for cardiac recipients in France: single-centre 8-year experience

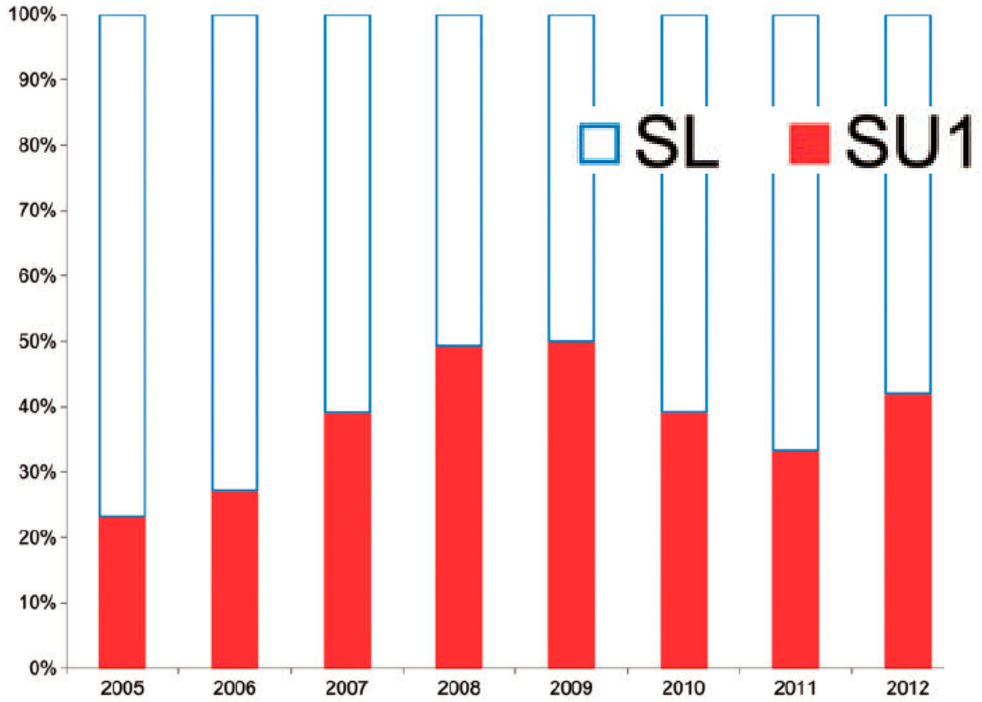
Criteria Special Urgency1 status(granted for 48 h, renewable once)

. continuous infusion of intravenous inotropic drugs Dobutamine 10mg/kg/min, epi or norepi 0.1mg/kg/min

. extracorporeal membrane oxygenator

. intra-aortic balloon pump support

in whom a VAD or total artificial heart (TAH) was indicated in order to avoid the bridge-to-bridge step and directly move towards transplantation



European Journal of Cardio-Thoracic Surgery 51 (2017) 271–278

High-urgency waiting list for cardiac recipients in France: single-centre 8-year experience

	Overall		
	SL (*n* =297)	SU1 (*n* =212)	*P*-value
Gender (female)	78 (26%)	39 (18%)	0.04
Age (years)	51 ± 13	47 ± 15	<0.01
Age ≥ 50 years	198 (67%)	114 (54%)	<0.01
Age ≥ 60 years	83 (28%)	52 (25%)	0.39
Weight (kg)	70 ± 14	73 ± 16	0.11
Height (cm)	170 ± 8	173 ± 8	<0.01
BSA (m^2)	1.82 ± 0.20	1.86 ± 0.23	0.06
Diagnosis			
Ischaemic	101 (34%)	64 (30%)	0.36
Idiopathic	114 (38%)	95 (45%)	0.15
Congenital	9 (3%)	2 (1%)	0.11
Other	73 (25%)	51 (24%)	0.89
Time on waiting list (days)	160 ± 283	40 ± 94	<0.01
Diabetes	48 (16%)	42 (20%)	0.29
Insulin-dependent	30 (10%)	14 (7%)	0.16
Noninsulin-dependent	18 (6%)	28 (13%)	<0.01
Serum creatinine (µmol/l)	111 ± 50	121 ± 68	0.17
Creatinine clearance (ml/min)	77 ± 38	88 ± 52	<0.01
Prior sternotomy	77 (26%)	66 (31%)	0.2
CRT	70 (24%)	42 (20%)	0.31
ICD	134 (45%)	79 (37%)	0.08
History of vascular disease	19 (6%)	7 (3%)	0.12
Inotrope dependent	28 (9%)	164 (77%)	<0.01
Preoperative ECMO	8 (3%)	81 (38%)	<0.01
Peripheral	3 (1%)	44 (21%)	<0.01
Central	5 (2%)	37 (17%)	<0.01
Ventilator dependent	4 (1%)	41 (19%)	<0.01

	All (*n* = 212)	Era I (*n* = 101)(2005/08)	Era II (*n* = 111)(2009/12)	*P*-value
Recipient				
Preoperative ECMO	81 (38%)	41 (41%)	40 (36%)	0.49
Peripheral canulation	44 (21%)	14 (14%)	30 (27%)	<0.01
Central canulation	37 (17%)	27 (27%)	10 (9%)	<0.01

High-urgency waiting list for cardiac recipients in France: single-centre 8-year experience

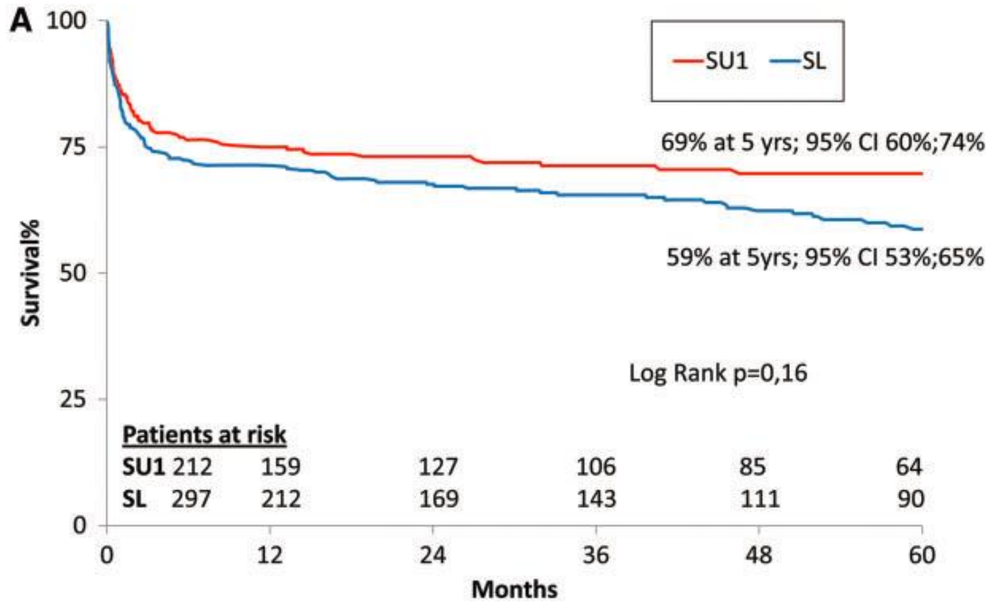


Table 3: Risk factors for mortality: Propensity-score multivariable analysis

1-Year mortality	OR	95% CI	*P*-value	*c*-Statistics
Recipient				0.72
Propensity score	1.04	0.91–1.19	0.57	
SU1 priority status	0.70	0.31–1.56	0.38	
Recipient age > 60 years	2.99	1.50–5.96	<0.01	
Ventilator dependent	3.60	1.08–12.01	0.04	
Donor				
Gender mismatch	0.49	0.28–0.86	0.01	
Age	1.03	1.004–1.06	0.03	

1-Year mortality, multivariate	OR	95% CI	*P*-value
Recipient			
Insulin-dependent diabetes	3.84	1.08–13.65	0.04
History of vascular disease	7.674	1.31–45.12	0.02
Creatinine[a]	1.01	1.01–1.02	<0.01
Donor			
Male Rec./Female Don.	2.62	1.15–5.96	0.02

CONCLUSIONS: Special Urgency1 waiting list allows allocating cardiac donors for critically ill patients without increasing early and midterm mortality. Careful selection of recipients is mandatory in order to improve outcomes.

Clinical outcomes of temporary mechanical circulatory support as a direct bridge to heart transplantation: a nationwide Spanish registry

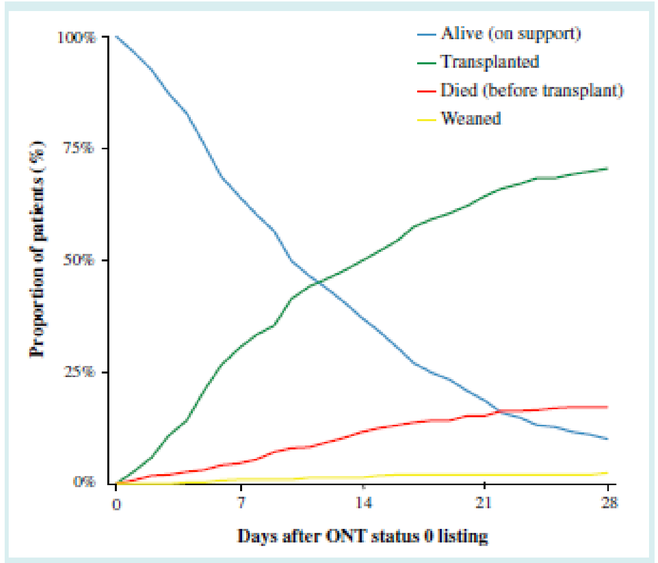
Table 1 Devices in place at the time of high-urgent listing

Devices	Patients, n
VA-ECMO	169 (58%)
Peripheral insertion, femoral artery[a]	144
Peripheral insertion, other artery[a]	17
Central insertion[b]	8
T-LVAD	70 (24%)
Levitronix CentriMag[b]	51
Impella Recover[a]	12
Abiomed BVS 5000[c]	6
Maquet Rotaflow[b]	1
T-BiVAD	52 (18%)
Levitronix CentriMag[b]	36
Abiomed BVS 5000[c]	14
Abiomed AB 5000[c]	1
Sorin Revolution[b]	1

Variables	T-LVAD (n = 70)	T-BiVAD (n = 52)	VA-ECMO (n = 169)	P-value
Clinical history				
Age (years)	52 ± 12	52 ± 10	50 ± 13	0.517
Female sex	22.9%	23.1%	34.3%	0.967
Body mass index (kg/m^2)	25 ± 4	26 ± 4	26 ± 5	0.313
Days from hospital admission to device insertion	10 ± 15	14 ± 22	12 ± 20	0.440
Days from device insertion to high-urgent listing	11 ± 14	7 ± 9	3 ± 5	<0.001
Patients in waiting list prior to device insertion	28.6%	23.1%	27.8%	0.948
Ischaemic heart disease	61.4%	44.2%	53.3%	0.168
Cardiogenic shock related to acute myocardial infarction	47.1%	25.0%	3.2%	0.023
Cardiogenic shock following cardiac surgery	4.3%	13.5%	10.1%	0.194
Diabetes mellitus	15.7%	23.1%	25.4%	0.262
Hypertension	24.3%	34.6%	33.1%	0.344
Hypercholesterolaemia	30%	36.5%	33.1%	0.748
Previous open-chest cardiac surgery	8.6%	15.4%	26.6%	0.004

In-hospital postoperative outcomes					
Excessive surgical bleeding	72 (31%)	15 (25%)	18 (43%)	39 (30%)	0.163
Primary graft failure	75 (33%)	16 (27%)	17 (41%)	42 (33%)	0.369
Right ventricular failure	41 (18%)	7 (12%)	10 (24%)	24 (19%)	0.645
Left ventricular or biventricular failure	34 (15%)	9 (15%)	7 (17%)	18 (14%)	0.422
T-MCS after transplant	34 (15%)	7 (12%)	6 (14%)	21 (16%)	0.729
Open-chest redo surgery	40 (17%)	6 (10%)	10 (24%)	24 (19%)	0.176
Renal failure	64 (28%)	15 (25%)	15 (36%)	34 (26%)	0.447
Postoperative infection	121 (53%)	32 (54%)	23 (55%)	66 (51%)	0.883
In-hospital postoperative death	61 (26%)	7 (12%)	11 (26%)	43 (33%)	0.008
Days on ventilator after transplant	11 ± 17	8 ± 9	10 ± 14	13 ± 21	0.196
Days of ICU stay after transplant	18 ± 18	16 ± 22	20 ± 19	18 ± 19	0.725
Days of hospital stay after transplant	38 ± 37	36 ± 29	39 ± 34	38 ± 40	0.930

Outcomes and predictors of 1 y Mortality



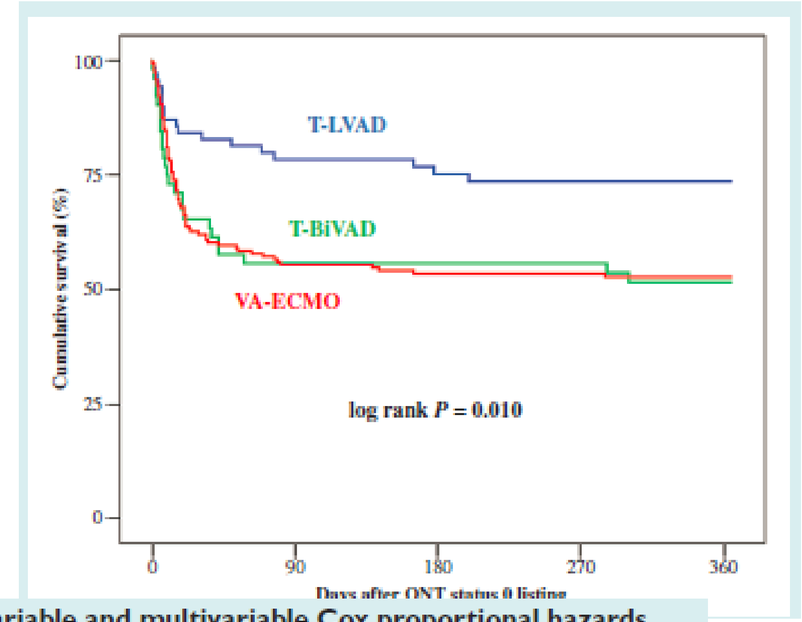


Table 4 Clinical predictors of 1-year all-cause mortality: univariable and multivariable Cox proportional hazards regression

	Univariable analysis			Multivariable analysis		
	Unadjusted HR	95% CI	*P*-value	Adjusted HR	95% CI	*P*-value
Age (per 10 years)	1.21	1.03–1.42	0.023	1.29	1.06–1.56	0.010
Vasoactive-inotropic score (per 10 units)	1.03	1.06–1.09	<0.001	1.07	1.04–1.10	<0.001
Creatinine (mg/dL)	1.33	1.10–1.60	0.004	–	–	–
Lactate (mmol/L)	1.11	1.03–1.21	0.009	1.10	1.00–1.20	0.049
Renal replacement therapy	2.22	1.35–3.67	<0.001	2.02	1.06–3.84	0.032
Isolated LVAD support	0.47	0.29–0.78	0.003	0.52	0.30–0.92	0.025
Mechanical ventilation	1.67	1.12–2.49	0.012	–	–	–
Intra-aortic balloon pump	1.48	1.03–2.12	0.033	–	–	–
Active infection requiring i.v. therapy	1.74	1.08–2.02	0.023	2.13	1.20–2.79	0.010
INTERMACS profile 1	2.03	1.42–2.90	<0.001	–	–	–

European Journal of Heart Failure (2018) 20, 178–186

Clinical outcomes of temporary mechanical circulatory support as a direct bridge to heart transplantation: a nationwide Spanish registry

- **Mean time from high-urgent listing to HT was 7.6±8.5 days (range 0–81 days),varying significantly among modalities of support (T-LVAD: 8.3±8.1 days; T-BiVAD: 10.5±3.4 days; VA-ECMO: 6.5±6.2 days;*P* =0.024).**

- **Rates of transplantation during support were 84.3%, 75% and 78.1% in patients listed on T-LVADs, T-BiVADs, and VA-ECMO, respectively (*P* =0.414). Rates of death during support (before transplantation) were 11.4%, 25% and 19.5%, respectively(*P* =0.143).**

Temporary devices may be used to bridge critically ill candidates directly to heart transplantation in a setting of short waiting list times, as is the case of Spain. In our series, bridging with T-LVAD was associated with more favourable outcomes than bridging with T-BiVAD or VA-ECMO.

European Journal of Heart Failure (2018) 20, 178–186

Extracorporeal membrane oxygenation as a direct bridge to heart transplantation in adults (US)

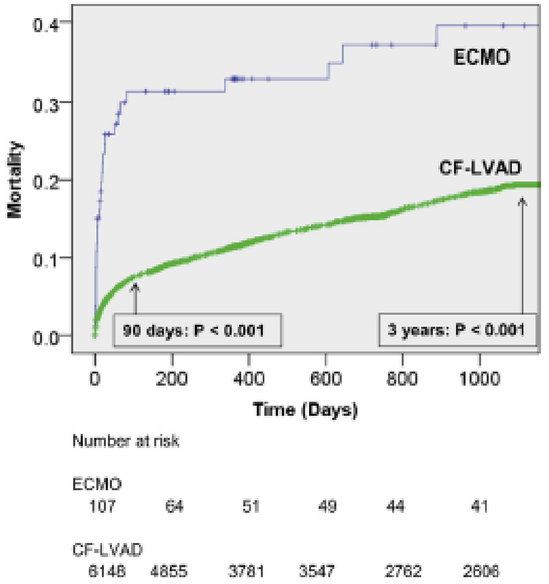
UNOS 2003-2016
ECMO-HTX vs CFLVAD-HTX

TABLE 1. Baseline recipient characteristics

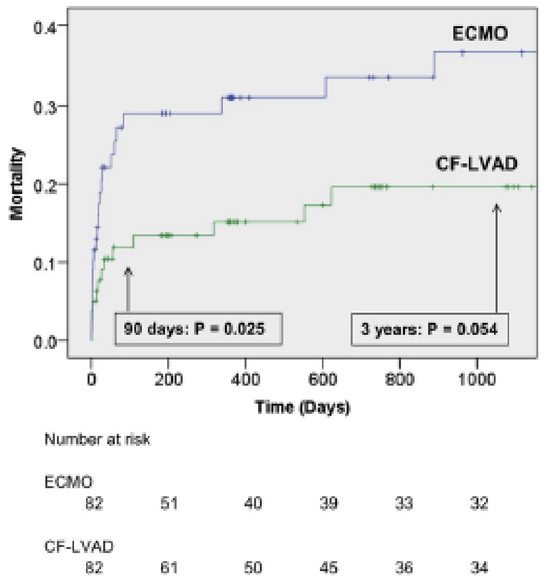
Characteristic	ECMO (n = 107)	CF-LVAD (n = 6148)	*P* value
Age	44.3 ± 15.2*	53.2 ± 12.2	<.001*
Total days on waiting list	123 ± 425*	305 ± 369*	<.001*
ECMO at listing	40 (37.4)*	33 (0.5)*	<.001*
Female gender	34 (31.8)*	1177 (19.1)*	.001*
Body mass index	25.6 ± 5.1*	28.3 ± 5.0*	<.001*
Heart failure etiology			<.001*
Dilated cardiomyopathy	43 (40.2)*	3309 (53.8)*	
Ischemic	32 (31.8)*	2523 (41.0)*	
Congenital	11 (10.3)*	36 (0.6)*	
Others	19 (17.8)*	280 (4.6)*	
Pulmonary vascular resistance (Woods units)	2.76 ± 1.96	2.31 ± 1.73	.042*
Mechanical ventilation	42 (39.3)*	43 (0.7)*	<.001*
IABP	26 (24.3)*	62 (1.0)*	<.001*
Inotropes	66 (61.7)*	479 (7.8)*	<.001*

Post HTX survival

ECMO vs CFLVAD-HT



ECMO vs CFLVAD (M)



The Journal of Thoracic and Cardiovascular Surgery 2018 Volume 155, Number 4

Extracorporeal membrane oxygenation as a direct bridge to heart transplantation in adults

TABLE 4. Posttransplant adverse events before and after propensity-score matching

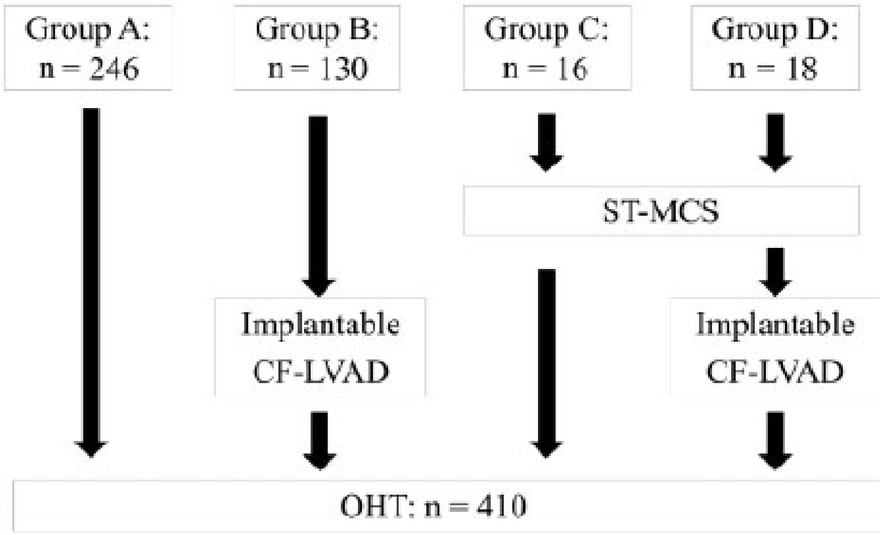
	Before propensity match			After propensity match		
	ECMO (n = 107)	CF-LVAD (n = 6148)	*P* value	ECMO (n = 82)	CF-LVAD (n = 82)	*P* value
Graft failure	8 (7.5)	366 (6.0)	.51	6 (7.3)	7 (8.5)	.77
Primary	6 (5.6)*	132 (2.1)*	.016*	5 (6.1)	5 (6.1)	1.00
Acute/chronic rejection	2 (1.9)	130 (2.1)	.86	1 (1.2)	2 (2.4)	1.00
Others	0	104 (1.7)	.18	0	0	
Episode of rejection	25 (24.3)	1154 (18.8)	.16	20 (24.4)	17 (20.7)	.58
Functional status at the most recent follow-up			<.001*			.20
Total assistance	32 (49.2)*	546 (12.8)*		22 (44.9)	15 (27.8)	
Some assistance	5 (7.7)*	681 (15.9)*		5 (10.2)	7 (13.0)	
No assistance	28 (43.1)*	3045 (71.3)*		22 (44.9)	32 (59.3)	
Pacemaker insertion	0*	227 (3.7)*	.034*	0	2 (2.5)	.25
Renal insufficiency requiring dialysis	22 (21.2)*	684 (11.3)*	.002*	14 (17.1)	9 (11.0)	.26
CVA	10 (9.4)*	202 (3.3)*	.001*	7 (8.5)	3 (3.7)	.33

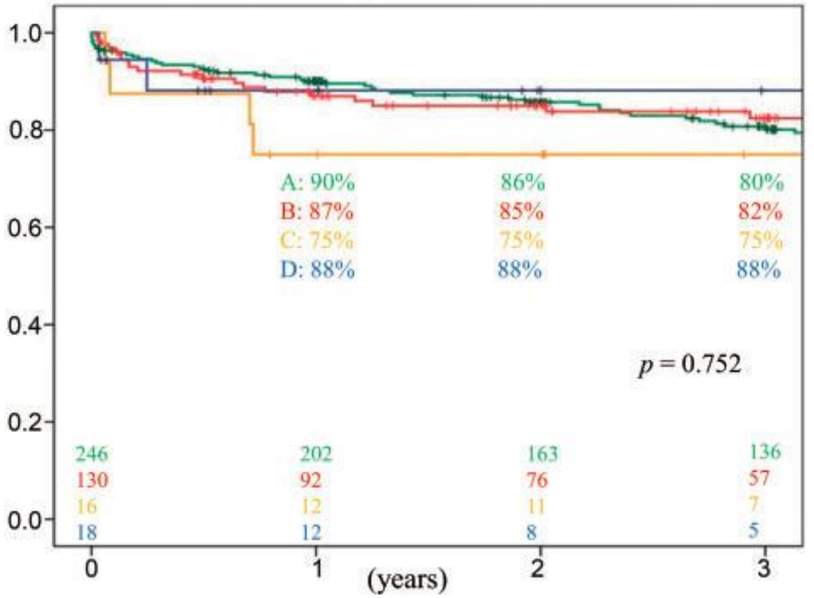
TABLE 5. Primary causes of death in each group before and after propensity-score matching

	Before propensity matching			After propensity matching		
Cause of death	ECMO (n = 37)	CF-LVAD (n = 1099)	*P* value	ECMO (n = 27)	CF-LVAD (n = 14)	*P* value
Graft failure	7 (18.9)	155 (14.1)	.41	6 (22.2)	4 (28.6)	.71
Infection	3 (8.1)	181 (16.5)	.20	3 (11.1)	2 (14.3)	1.00
Cardiovascular	4 (10.8)	190 (17.3)	.18	2 (7.4)	2 (14.3)	.60
Pulmonary	1 (2.7)	62 (5.6)	.44	0	0	1.00
CVA	4 (10.8)	63 (5.7)	.28	3 (11.1)	2 (14.3)	1.00
Multiorgan failure	10 (27.0)*	136 (12.4)*	.009*	6 (22.2)	2 (14.3)	.69
Others	8 (21.6)	312 (28.4)	.37	7 (25.9)	2 (14.3)	.69

Outcome of heart transplantation after bridge-to-transplant strategy using various mechanical circulatory support devices

ECMO/Imp





Perioperative complication					
Stroke, *n* (%)	4 (2)	2 (2)	2 (13)	1 (6)	0.022
Haemodialysis, *n* (%)	31 (13)	20 (15)	1 (6)	1 (6)	0.563
Acute rejection, *n* (%)	53 (22)	32 (25)	2 (13)	2 (11)	0.335
Use of ST-MCS, *n* (%)	10 (4)	23 (18)	1 (6)	2 (11)	<0.001
Hospital duration (days)	17 (13–25)	19 (15–28)	25 (16–45)	16 (14–27)	0.105
Hospital mortality, *n* (%)	10 (4)	10 (8)	2 (13)	1 (6)	0.307

Interactive CardioVascular and Thoracic Surgery 25 (2017) 918–924

So… When do we use ECMO as BTT?

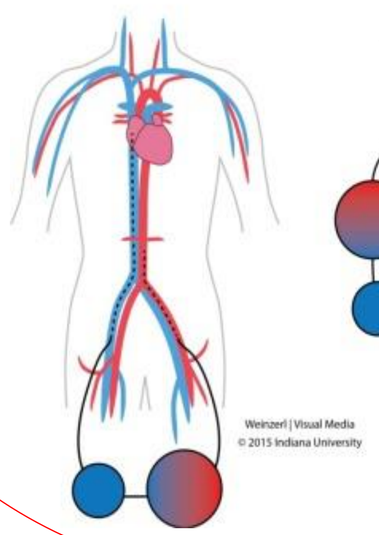
Who should we Bridge on ECMO as BTT

- Myocarditis (potential for recovery)
- Biventricular Failure (Re-transplants)
- Poor LVAD candidates (restrictive,congenital)
- Previous sternotomies
- Young patients (to prevent LVAD complications?)

TBD!

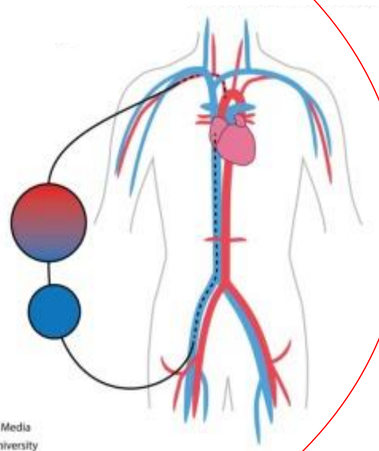
How should patients be supported
Cannulation Strategies for VA ECMO

Femoral – Femoral



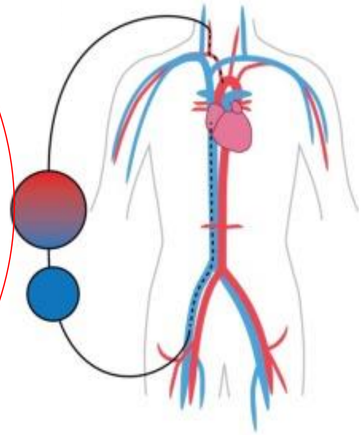
- Rapid initiation of support

Axillary – Femoral



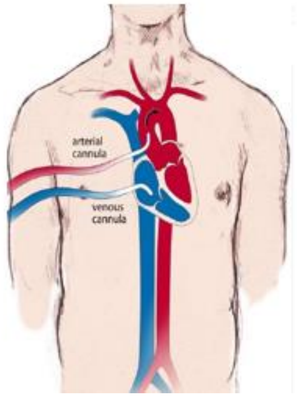
- Reduces risk of cerebral hypoxia
- Advantages in patients with PAD

Carotid – Femoral



- Pediatric application

Central AO-RA



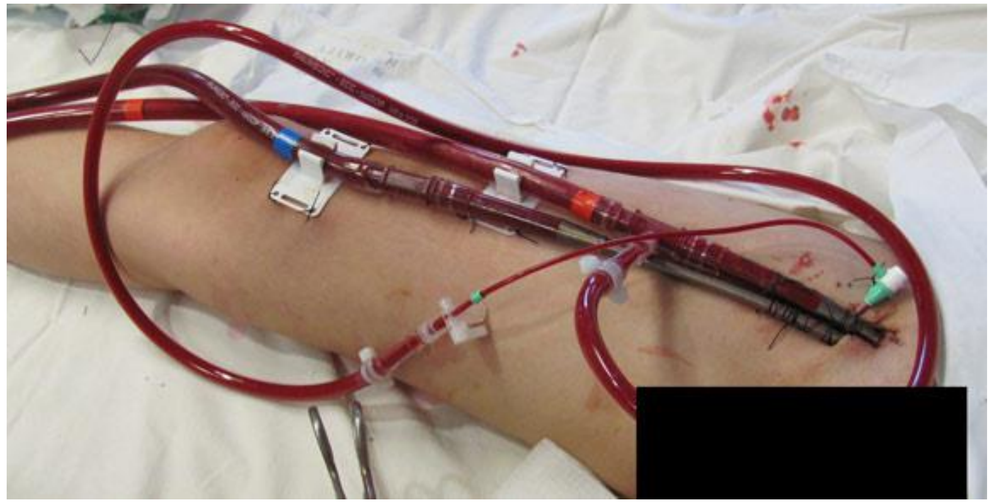
- Frequently used in post-cardiotomy failure
- Superior Drainage

Makdisi G, Wang I. J Thoracic Dis. 2015

Limitations of the different cannulation techniques

Femoral

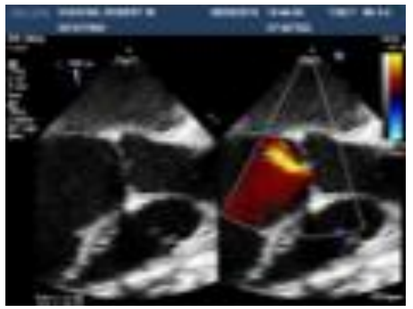
Limits mobility
Limb complications

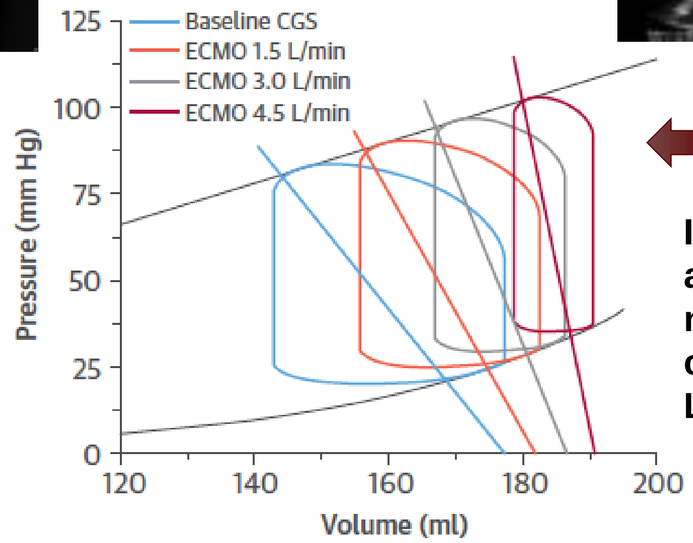


Axillary

Allows mobility
Antegrade flow
Bleeding

Hemodynamic Effects of Peripheral VA-ECMO

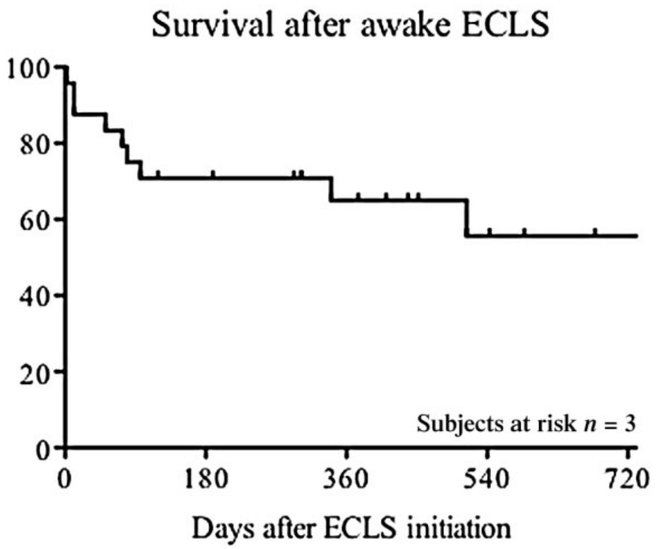




Increased afterload reduces native CO and causes increase in LVEDP and LVEDV

Burkhoff et al. J Am Coll Cardiol 2015;66:2663–74

Cardiac Awake Extracorporeal Life Support
Bridge to Decision



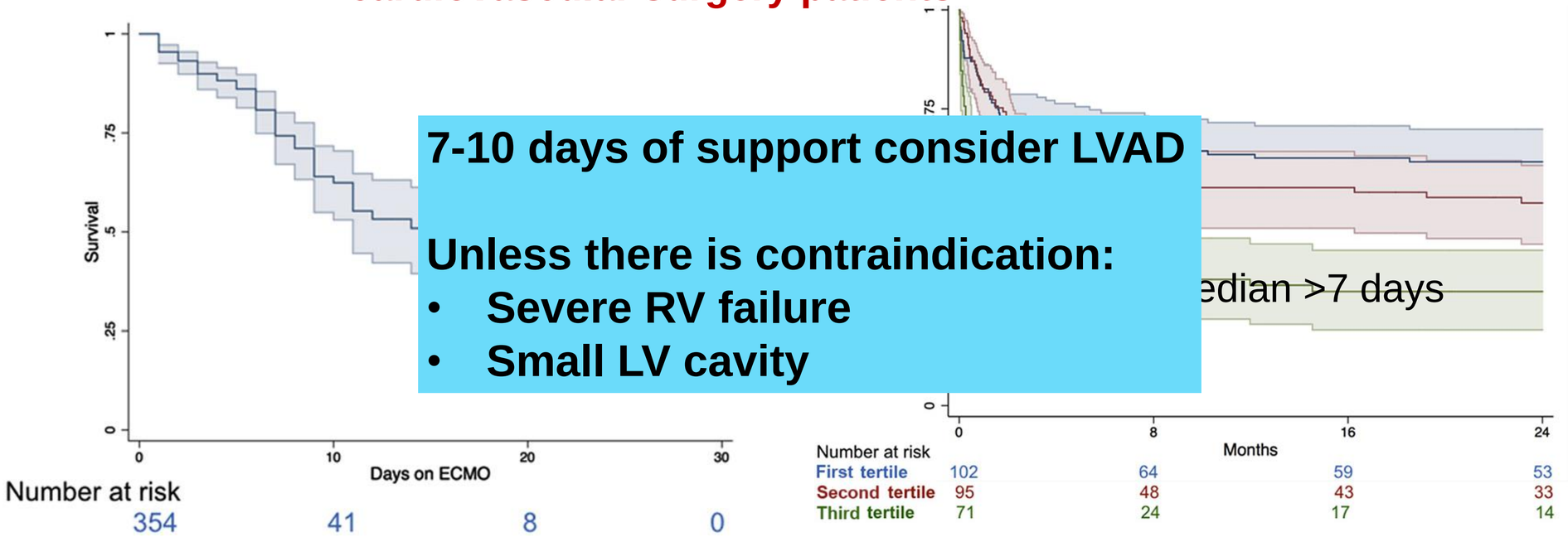
Patient	Age	Sex	Diagnosis	Duration of ECLS (days)	Outcome/destination therapy
1	46	Male	Myocarditis	7	VAD
2	29	Male	Graft failure 65 months after HTX	8	Death
3	57	Male	Graft failure 13 months after HTX	12	VAD
4	39	Female	Graft failure 16 weeks after HTX	9	VAD
5	57	Male	Graft failure 18 weeks after HTX	24	VAD
6	21	Female	Graft failure 4.5 years after HTX	9	Re-heart transplantation
7	46	Male	Dilatative cardiomyopathy	14	VAD
8	75	Male	Ischemic cardiomyopathy	4	VAD
9	26	Female	Myocarditis	4	VAD
10	49	Female	Dilatative cardiomyopathy	14	VAD
11	49	Male	Cardiogenic shock, unknown origin	6	VAD
12	53	Male	Ischemic cardiomyopathy	5	VAD
13	48	Male	Ischemic cardiomyopathy	10	VAD
14	27	Female	Restrictive cardiomyopathy	52	Heart transplantation
15	75	Female	Mitral valve regurgitation IV°	6	Mitral valve replacement
16	39	Female	Biventricular failure in acute myeloid leukemia	2	Death
17	25	Male	Noncompaction cardiomyopathy	4	VAD
18	32	Male	Graft failure 14 years after HTX	48	Re-heart transplantation
19	47	Male	Ischemic cardiomyopathy	6	VAD
20	45	Male	Dilatative cardiomyopathy	8	VAD
21	70	Male	Acute ischemic mitral valve regurgitation IV°	5	Mitral valve replacement
22	43	Male	Ischemic cardiomyopathy	6	Recovery
23	60	Male	Dilatative cardiomyopathy	9	VAD

In acute cardiac failure, early ECLS treatment is a safe, feasible treatment in awake patients allowing a gain of time for final decision. Moreover, **this strategy avoids complications associated with sedation and mechanical ventilation and leads to recovery of secondary organ function, enabling destination therapy.**

Artif Organs ,39(5) Jan 2015

When do we consider an LVAD?

Duration of ECMO support and survival in cardiovascular surgery patients



7-10 days of support consider LVAD

Unless there is contraindication:

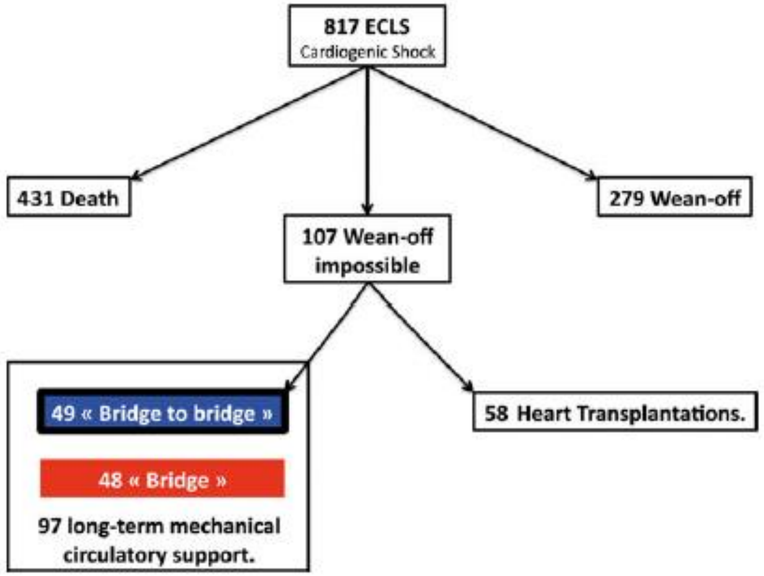
- **Severe RV failure**
- **Small LV cavity**

edian >7 days

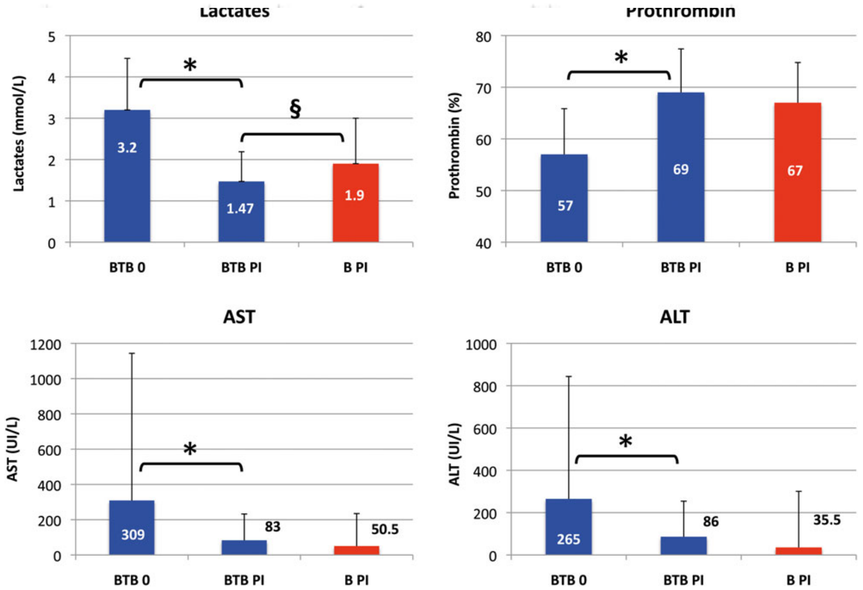
Conclusions: Prolonged venoarterial ECMO support is associated with poor outcome in adult patients after cardiovascular surgery. Our data suggest reevaluation of therapeutic strategies after 7 days of ECMO support because mortality disproportionally increases afterward.

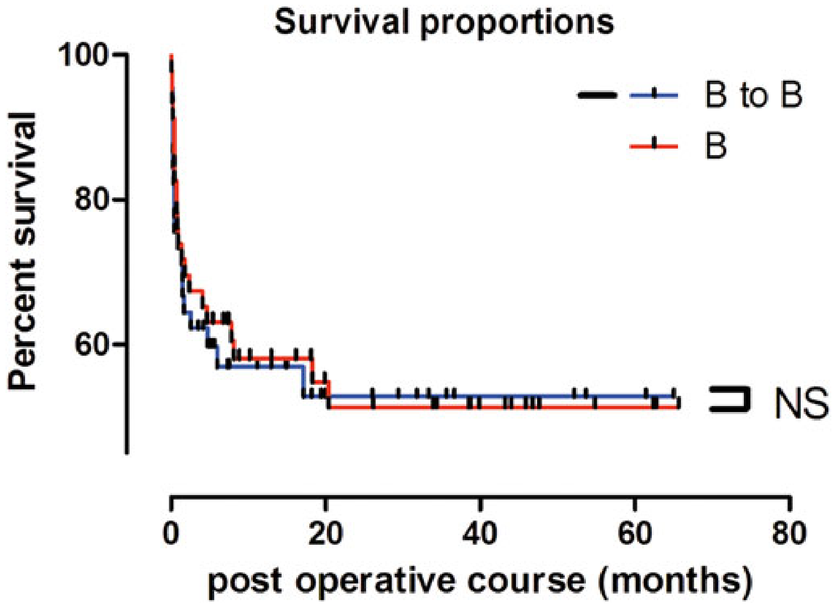
J Thorac Cardiovasc Surg 2018;-:1-6)

Extracorporeal life support as a bridge to bridge: safe option.



Parameters	Bridge	Bridge-to-bridge	*P*-value
n	48	49	
Age (years)	54,0 ± 12,6 [27–76]	48.3 ± 12.0 [17–72]	0.025
Gender			
Male	40 (83.3%)	40 (81.6%)	
Female	8 (16.7%)	9 (18.4%)	
ECLS			
Duration before		11,6 ± 11.9 [1–26]	
Ventricular assist device			
Peripheral ECLS		33	
Central ECLS		16	





European Journal of Cardio-Thoracic Surgery 48 (2015) 785–791

Summary

- ECMO as bridge to heart transplant is a viable strategy in selected patients although associated with increased perioperative mortality

- Recent changes in donor Heart Allocation policies may increase its use as a bridge to HTX.

- The implications and extent to this policy that left other high acuity patients relegated to status 2-3 are unclear.

- The need of expertise in the use of different options of short and long-term support options is warranted .

STS/EACTS Latin America Cardiovascular Surgery Conference

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THANK YOU