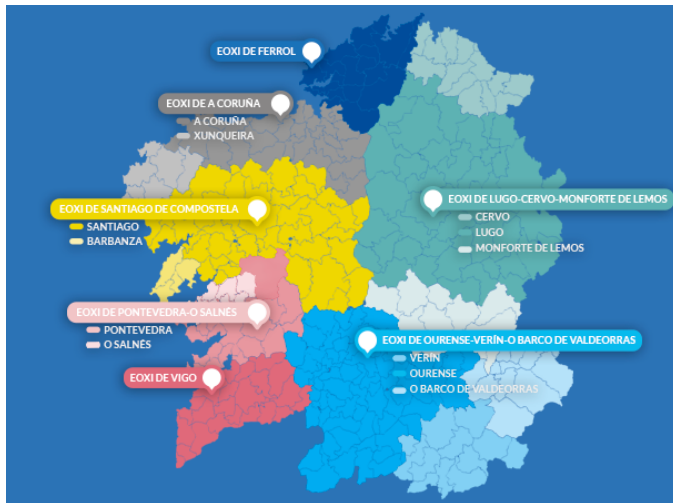




SESSION III SESIÓN III

Surgical and interventional approaches in advanced HF.
Abordaje quirúrgico e intervencionista en IC avanzada.

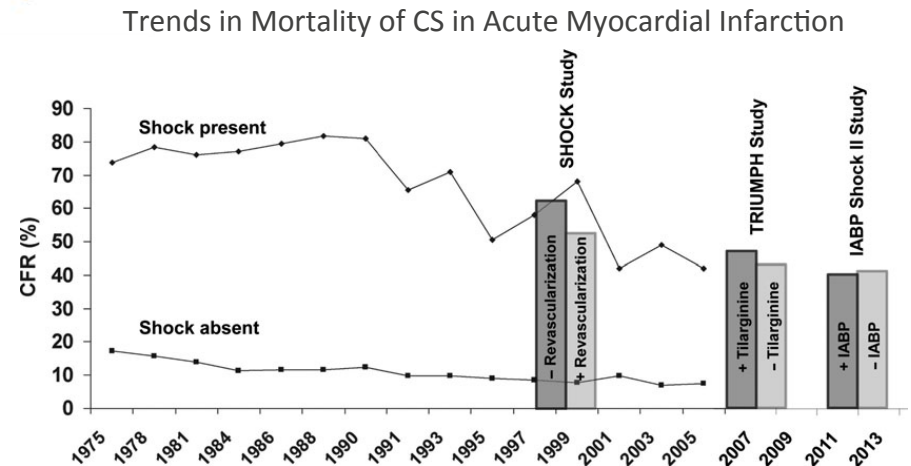
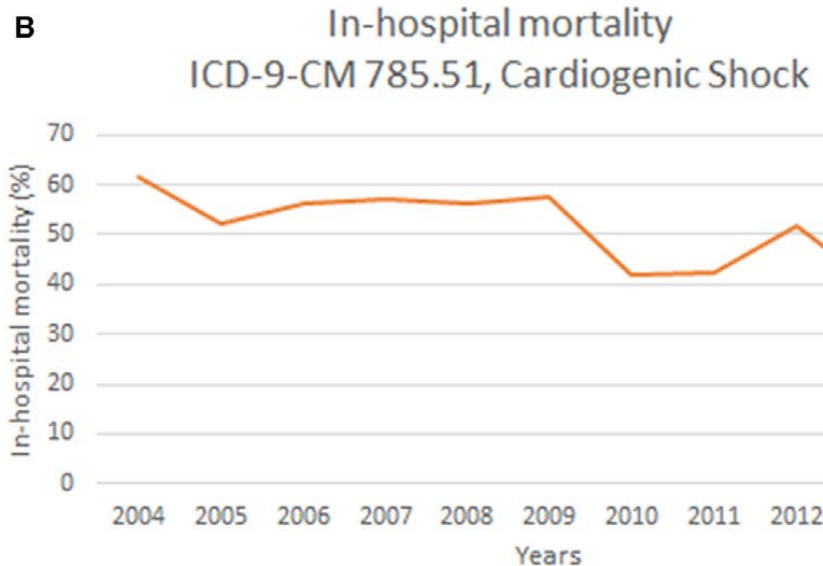


Five years of the interhospital management protocol of cardiogenic shock in Galicia.
Cinco años del protocolo de manejo interhospitalario del shock cardiogénico en Galicia.



Introduction

High mortality of Cardiogenic Shock: CS remains the most common cause of death in patients with AMI or ADHF



Werdan et al. Eur Heart J. 2014;35:156-167



Introduction

High mortality of Cardiogenic Shock: CS remains the most common cause of death in patients with AMI or ADHF

Characteristic	All (n = 219)	ACS (n = 177)	Non-ACS (n = 42)	P-value
Clinical findings, n (%)				
Cold periphery	207 (95)	166 (94)	41 (98)	0.4
Confusion	148 (68)	126 (71)	22 (52)	0.04
Oliguria	121 (55)	98 (55)	24 (57)	0.7
Lactate >2 mmol/L	155 (71)	126 (71)	29 (69)	0.9
Biochemistry				
Blood haemoglobin (g/L)	128 (22)	129 (22)	127 (21)	0.7
Sodium (mmol/L)	137 (5)	137 (5)	136 (7)	0.3
Potassium (mmol/L)	4.2 (0.8)	4.2 (0.8)	4.4 (0.9)	0.3
Arterial blood lactate (mmol/L)	2.8 (1.7–5.8)	3.0 (1.8–5.8)	2.6 (1.3–5.8)	0.3
Arterial blood pH	7.30 (7.20–7.40)	7.30 (7.20–7.40)	7.30 (7.20–7.40)	0.2
hsTnT (ng/L)	2190 (388–5418)	2873 (1056–7555)	104 (40–389)	<0.001
NT-proBNP (pg/mL)	2710 (585–9434)	1948 (472–9093)	6431 (2522–14064)	0.006
Creatinine (mmol/L)	104 (78–140)	101 (79–139)	111 (64–162)	0.8
eGFR (mL/min/1.73 m ²)	61 (41–87)	61 (42–86)	61 (32–97)	0.8
CRP (g/L)	16 (4–54)	13 (4–48)	29 (7–91)	0.03
In-hospital length of stay, days	12 (7–25)	11 (6–27)	16 (10–24)	0.11
In-hospital mortality, n (%)	80 (37)	70 (40)	10 (24)	0.06

Harjola et al. Eur J Heart Fail 2015;17:501509

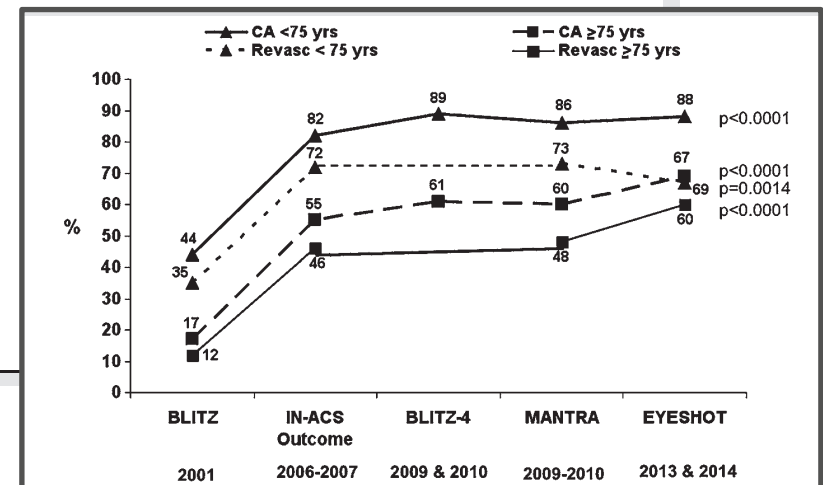
De Luca L. et al. Eur J Heart Fail. 2015; 17(11):1124-32



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eGFR (mL/min/1.73 m ²)	61 (41–87)			
CRP (g/L)	16 (4–54)			
In-hospital length of stay, days	12 (7–25)			
In-hospital mortality, n (%)	80 (37)			



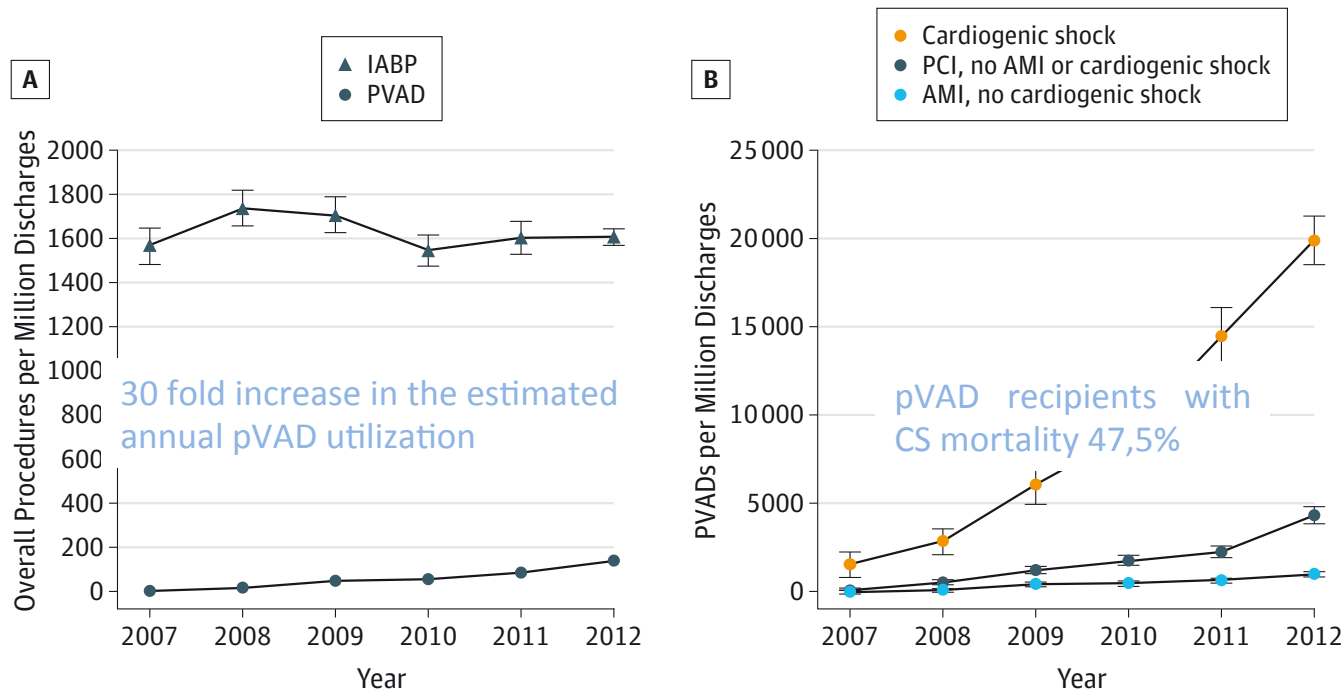
Harjola et al. Eur J Heart Fail 2015;17:501509

De Luca L. et al. Eur J Heart Fail. 2015; 17(11):1124-32



Introduction

pVADs are increasingly used in patients with CS



Khera et al. JAMA Intern Med 2015;175(6):941-950

Short-term mechanical circulatory support may be considered in refractory cardiogenic shock depending on patient age, comorbidities and neurological function.

IIb

C

2016 ESC Guidelines Acute and Chronic HF.



Introduction

... In hospital mortality in CS patients continues to rise ...

- American CathPCI Registry

TABLE 3 Unadjusted In-Hospital Outcomes for Cardiogenic Shock in the Setting of Acute Myocardial Infarction Patients Undergoing Percutaneous Coronary Intervention

	2005-2006 (n = 5,658)	2006-2008 (n = 10,337)	2009-2010 (n = 13,562)	2011-2013 (n = 26,940)	p Value
Ischemic stroke	1.4	1.3	1.4	1.4	0.80
Renal failure	5.3	6.4	3.1	3.1	<0.01
Any vascular complications	1.6	1.3	1.4	1.2	0.06
RBC transfusion	23.1	23.5	18.7	15.3	<0.01
Bleeding event <72 h	11.5	12.3	10.0	8.7	<0.01
Mortality	27.6	27.4	28.2	30.6	<0.01

Values are %.

... It is disconcerting to note that despite employing the state-of-art medicines and devices to treat these high-risk patients, in-hospital mortality continues to rise from 27,6% in 2005 -2006 to 30,6% in 2011 - 2013 (p< 0,01) ...

Optimize Resources
 Networking

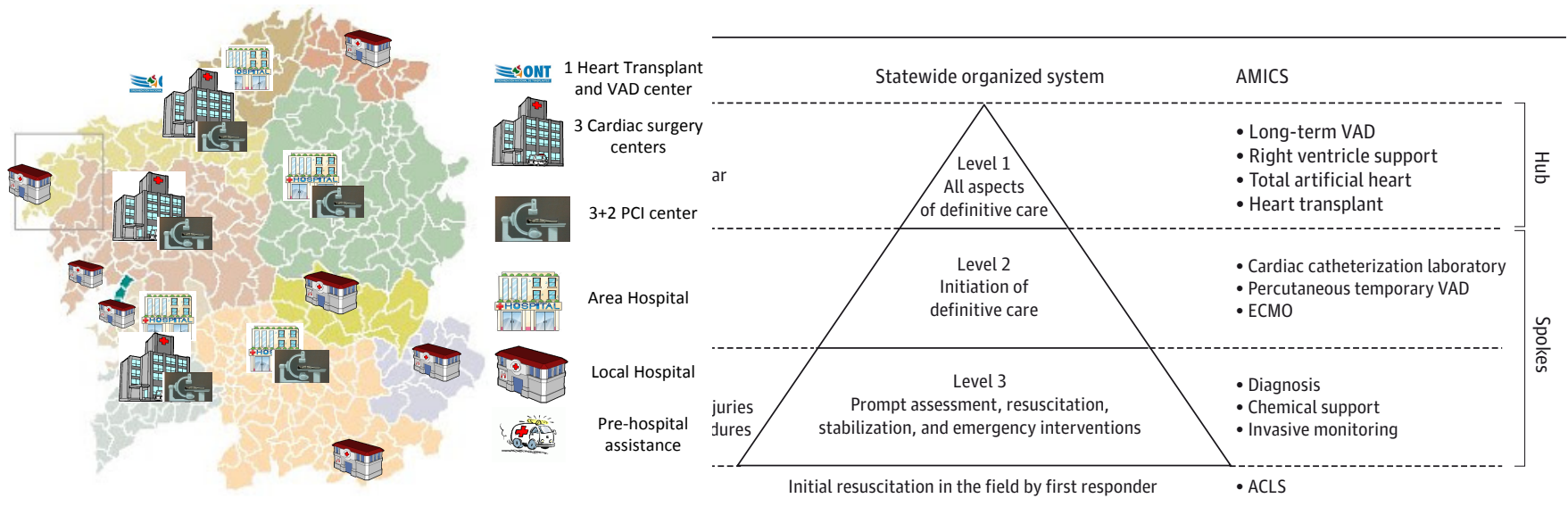
Wayangankar SA et al. JACC Cardiovasc Interv 2016;9(4):341-51



How to do it in Galicia?

Hub - and – spoke network model

... development of a network of centers with differing capabilities to efficiently and effectively triage, stabilize, and treat this population.



SERGAS Clinical Organizational Structure

Tchantchaleishvili V et al. JAMA Surg 2015;150(11):1025-6



How to do it in Galicia?

Clinical case

42 years old man without relevant medical history

Admitted with fever and dysnea in a local hospital.

Suppurative hydrosadenitis: Staphylococcus aureus bacteremia

Physical examination revealed crepitating rales heard over bilateral lung fields.

On auscultation, a grade 2-3/6 diastolic murmur

TEE: Severe Aortic regurgitation and mobile mass compatible with vegetation



Aortic Native Valve Infective Endocarditis

Treatment: Cloxacillin + Daptomycin and Aortic valve replacement

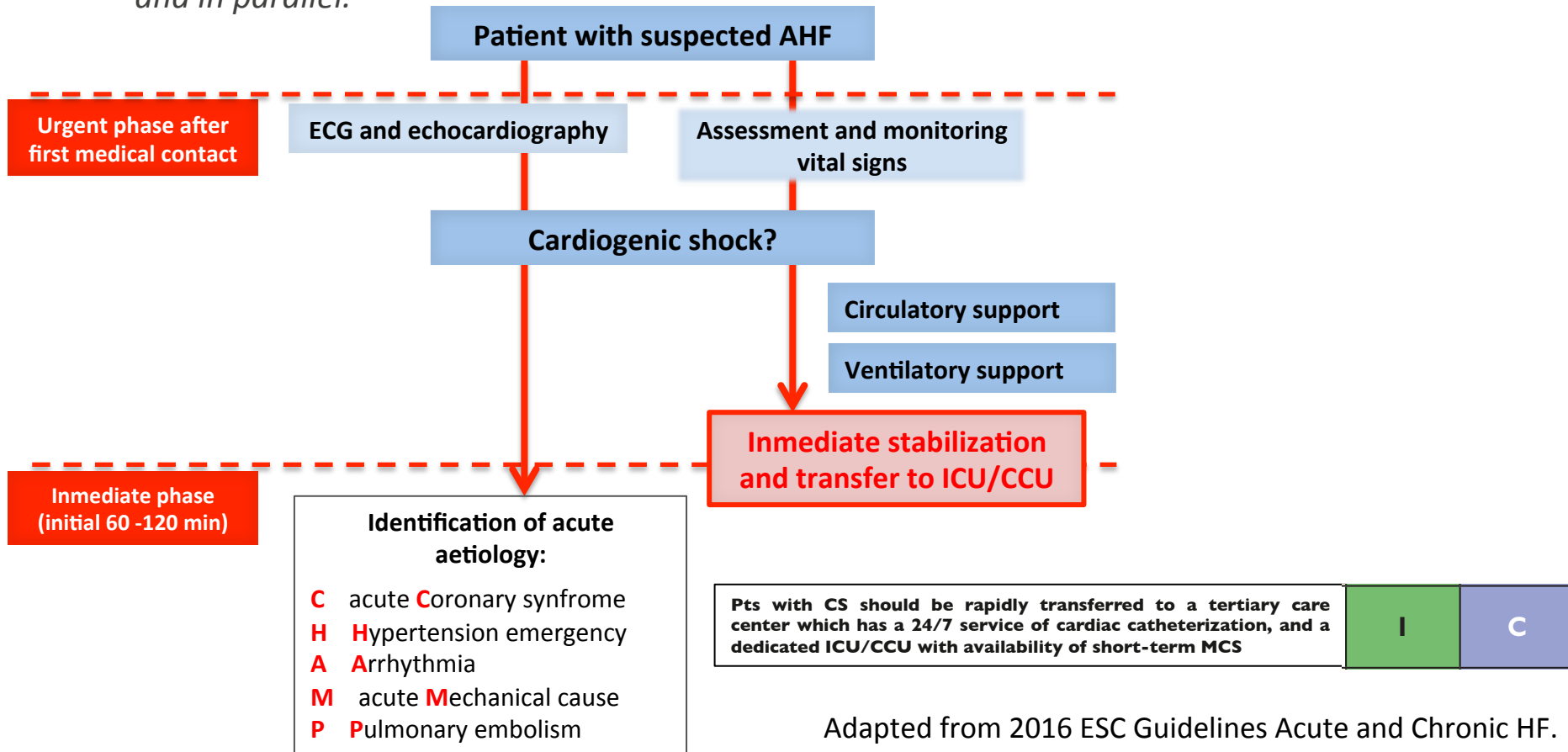
Readmitted 11 days later with dysnea, tachycardia, poor perfusion and congestion.



How to do it in Galicia?

Level 3: Initial management of a patient with AHF

“AHF is a life-threatening medical ... Early diagnosis is important ... a diagnostic workup and appropriate pharmacological and non-pharmacological treatment should be started promptly and in parallel.”



Five years of the interhospital management protocol of cardiogenic shock in Galicia.

Adapted from 2016 ESC Guidelines Acute and Chronic HF.





How to do it in Galicia?

Level 2: Initiation of definitive care

- Two clinical scenarios: Acute HF vs Acute Decompensated Chronic HF

Characteristics	Total	De novo AHF		<i>p</i> value de novo AHF, yes versus no
		Yes	No ^b	
Patients, <i>n</i> (%)	4,953	1,792 (36.2)	3,161 (63.8)	
Age (years)				<0.0001
<50	9.5	15.4	6.2	
51–60	16.5	18.0	15.7	
61–70	29.3	28.4	29.8	
71–80	29.8	26.1	31.8	
>80	14.9	12.1	16.5	
Male gender (%)	62.4	63.6	61.7	0.19
Underlying diseases				
Chronic systolic heart failure (%)	36.4	2.6	55.4	<0.0001
Coronary artery disease (%)	30.7	25.4	33.7	<0.0001
Hypertension (%) ^a	70.2	66.3	72.4	<0.0001
Diabetes (%)	45.3	38.8	49.0	<0.0001
Atrial fibrillation/flutter (%)	24.4	13.4	30.6	<0.0001
Chronic renal disease (as reported) (%)	21.4	11.0	27.1	<0.0001
Anaemia (%)	14.4	8.9	17.4	<0.0001
COPD/asthma (%)	24.8	15.8	29.7	<0.0001
Pacemaker (%)	5.5	2.2	7.4	<0.0001
Cardiomyopathy (%)	12.6	6.2	16.3	<0.0001
Precipitating factors (on admission)				
Acute coronary syndrome (%)	36.9	48.6	30.2	<0.0001
Arrhythmia (%)	26.9	19.1	31.3	<0.0001
Infection (%)	16.3	12.1	18.7	<0.0001
Poor compliance with medications (%)	13.4	2.2	19.7	<0.0001

- Age and Underlying diseases.
- Prolonged abnormal hemodynamics and neurohormonal perturbations: MODS
- Precipitating factors

Variable	De novo AHF		<i>p</i> value
	Yes, <i>n</i> = 1,792	No, <i>n</i> = 3,161	
Median SBP (mmHg) (IQR)	130 (95–160)	130 (103–160)	<0.0001
SBP < 100 (mmHg), no. (%)	466 (26.3)	549 (17.5)	<0.0001
Median DBP (mmHg) (IQR)	75 (60–90)	80 (60–95)	<0.0001
Heart rate, median (IQR)	110 (90–122)	107 (90–120)	0.002
Cardiogenic shock (%)	19.1	7.5	<0.0001
Pulmonary edema (%)	39.8	35.0	0.0008
Cold extremities (%)	29.3	24.3	0.0001
Normal diuresis at baseline (%)	55.2	52.6	0.093
Median BNP (IQR) ^a	908 (415–1,572)	1,040 (576–2,212)	0.020

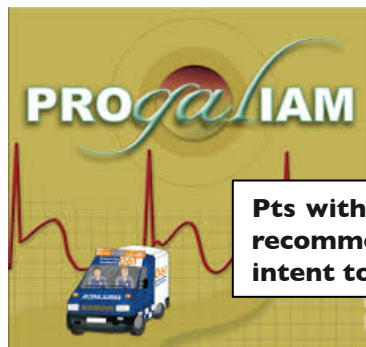
Follath et al. Intensive Care Med 2011;37:619-626
 Loyaga-Rendon et al. Circ Heart Fail 2015;8:953-959



How to do it in Galicia?

Level 2: Initiation of definitive care

- Acute HF “de novo”



Pts with CS complicating ACS an immediate coronary angiography is recommended (within 2 hours from hospital admission) with an intent to perform coronary revascularization.

I	C
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- Acute Decompensated Chronic HF: Transplant or MCS eligibility pts

In progressive or refractory cardiogenic shock in a patient hospitalized for decompensated heart failure in a center without circulatory support, prompt transfer to a tertiary care center to implement veno-arterial ECMO followed by transfer of the patient on ECMO to an expert center is recommended.

(strong agreement)

Levy et al. Ann of Int Care 2015;5:17-26

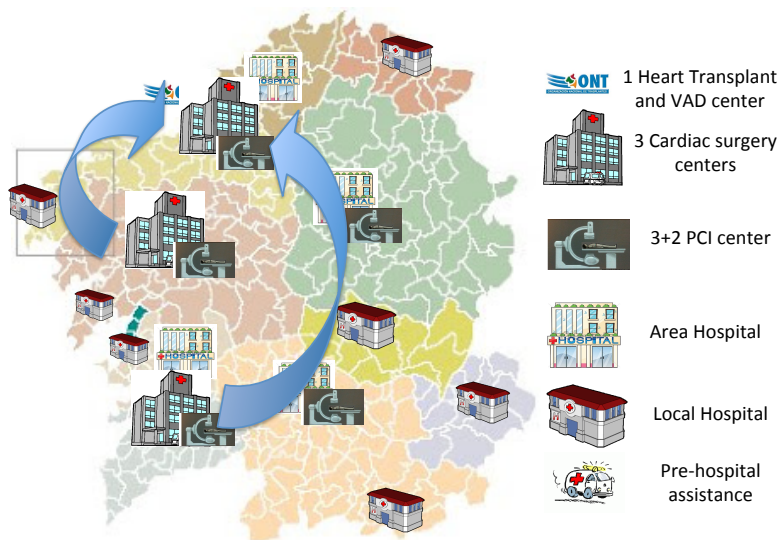


How to do it in Galicia?

Level 1: Definitive care

- Transfer for definitive care

- End-stage decompensated heart failure considered eligible for heart Tx should be rapidly managed in the expert center that conducted the assessment.
- Patients stable on Short-Term MCS and without cardiac recovery should be transfer to Heart-transplant /Durable VAD center.



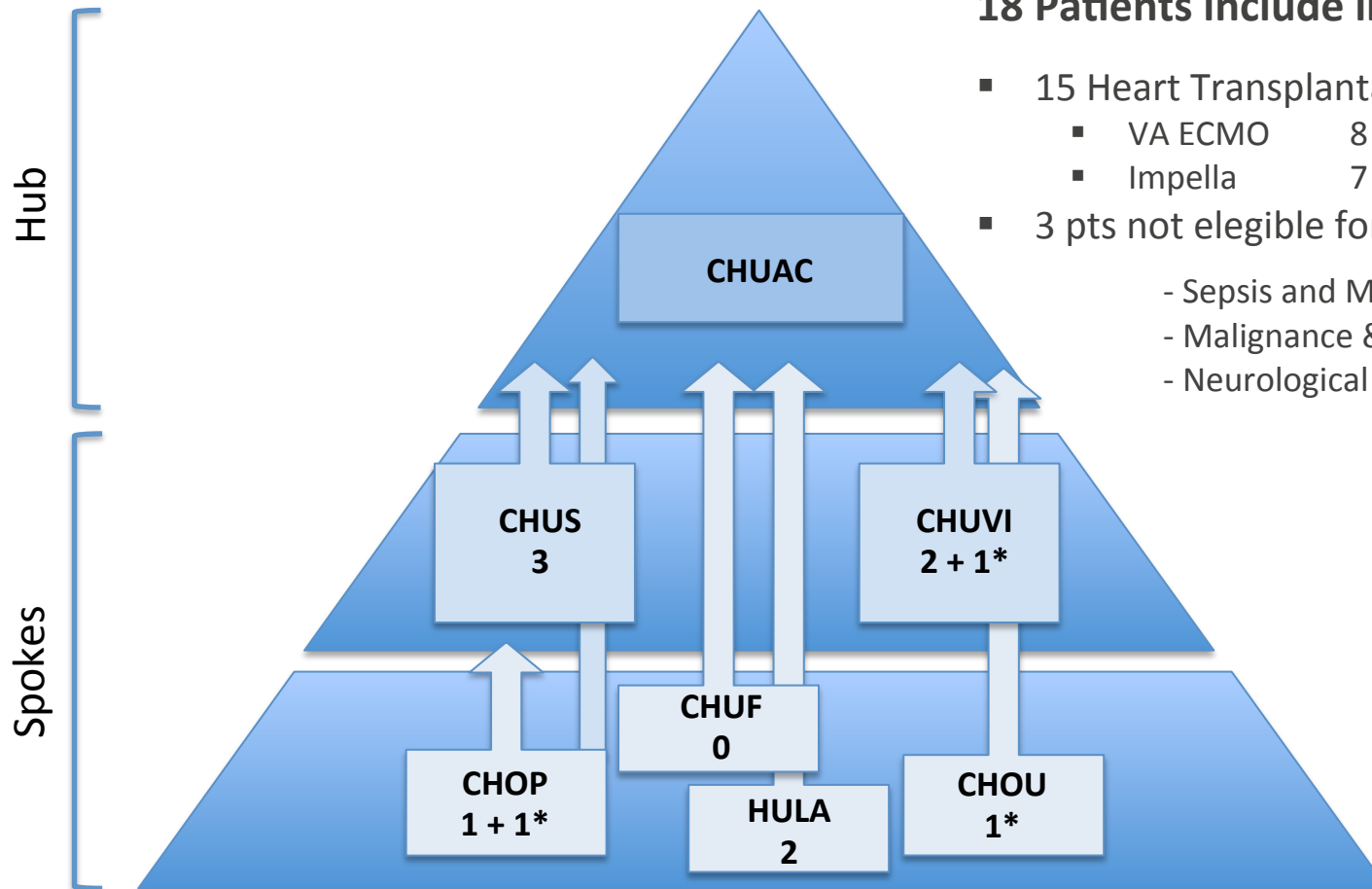
SERGAS Clinical Organizational Structure



PROTOCOLO AUTÓNOMICO
DE TRANSPORTE INTERHOSPITALARIO DEL PACIENTE EN
SHOCK CARDIOGÉNICO REFRACTARIO Y CANDIDATO A
TRASPLANTE CARDÍACO



Our experience ...



18 Patients include in our protocol:

- 15 Heart Transplantation (1 pt died after HTx)
 - VA ECMO 8
 - Impella 7
- 3 pts not eligible for HTx or MCS
 - Sepsis and MOF
 - Malignance & RV dysfunction
 - Neurological damage (Cardiac arrest)

* INTERMACS 3 profile

Our experience ...



IV Meeting. State of the Art in
ADVANCED HEART FAILURE
 CLINICAL PRACTICE AND ORGANIZATIONAL MODELS

Patient	Sex	Age	Heart Condition	Acute or Chronic	INTERMACS profile	Short-Term MCS device	Time support	Outcome
1	Woman	37	Idiopathic Dilated Cardiomyopathy	Acute HF	1	Periph VA ECMO	16	Alive
2	Man	36	Becker Cardiomyopathy	AD Chronic HF	2	Impella 2.5 Femoral	6	Alive
3	Man	47	Ischemic Cardiomyopathy	Acute HF	1	Periph VA ECMO	11	Alive
4	Man	53	AMI Mechanical complications	Acute HF	1	Periph VA ECMO	12	Alive
5	Man	57	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	2*	Axillary VA ECMO	10	Died
6	Man	53	Arrhythmogenic right ventricular dysplasia	AD Chronic HF	2	Impella CP femoral	8	Alive
7	Man	39	Ischemic Cardiomyopathy	Acute HF	1	Periph VA ECMO	13	Alive
8	Man	68	Ischemic Cardiomyopathy	Acute HF	3**	Axillary Impella CP	5	Alive
9	Man	65	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	2	Axillary Impella CP	20	Alive
10	Man	55	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	2	Axillary Impella CP	12	Alive
11	Man	47	Ischemic Cardiomyopathy	Acute HF	2	Impella CP femoral	14	Alive
12	Man	41	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	1	Periph VA ECMO VA	15	Alive
13	Man	42	Infective Endocarditis	Acute HF	1	Periph VA ECMO	43	Alive
14	Man	56	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	2	Axillary Impella CP	10	Alive
15	Man	65	Idiopathic Dilated Cardiomyopathy	AD Chronic HF	1	Periph VA ECMO VA	10	Alive

Five years of the interhospital management protocol of cardiogenic shock in Galicia.

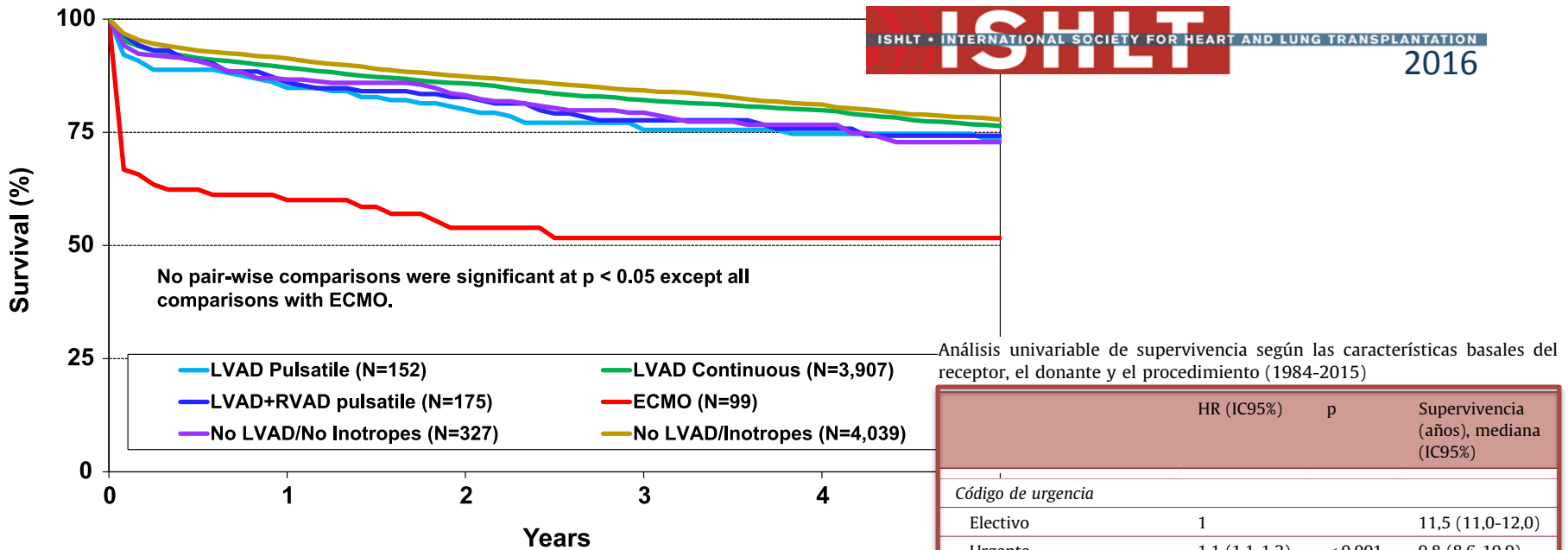


SERVIZO GALEGO de SAÚDE | Xerencia de Xestión Integrada A Coruña



Our experience ...

ECMO support and poor post-HTx Outcome



Análisis univariable de supervivencia según las características basales del receptor, el donante y el procedimiento (1984-2015)

	HR (IC95%)	p	Supervivencia (años), mediana (IC95%)
<i>Código de urgencia</i>			
Electivo	1		11,5 (11,0-12,0)
Urgente	1,1 (1,1-1,2)	< 0,001	9,8 (8,6-10,9)
<i>Tipo de asistencia*</i>			
Sin asistencia	1		—
Balón de contrapulsación	1,2 (0,9-1,2)	0,13	—
ECMO	1,6 (1,2-2,1)	0,003	—
Asistencia ventricular	0,9 (0,7-1,3)	0,77	—

Kaplan-Meier intermediate-term survival by pre-transplant mechanical circulatory support use (adult heart transplants: January 2009–June 2014)

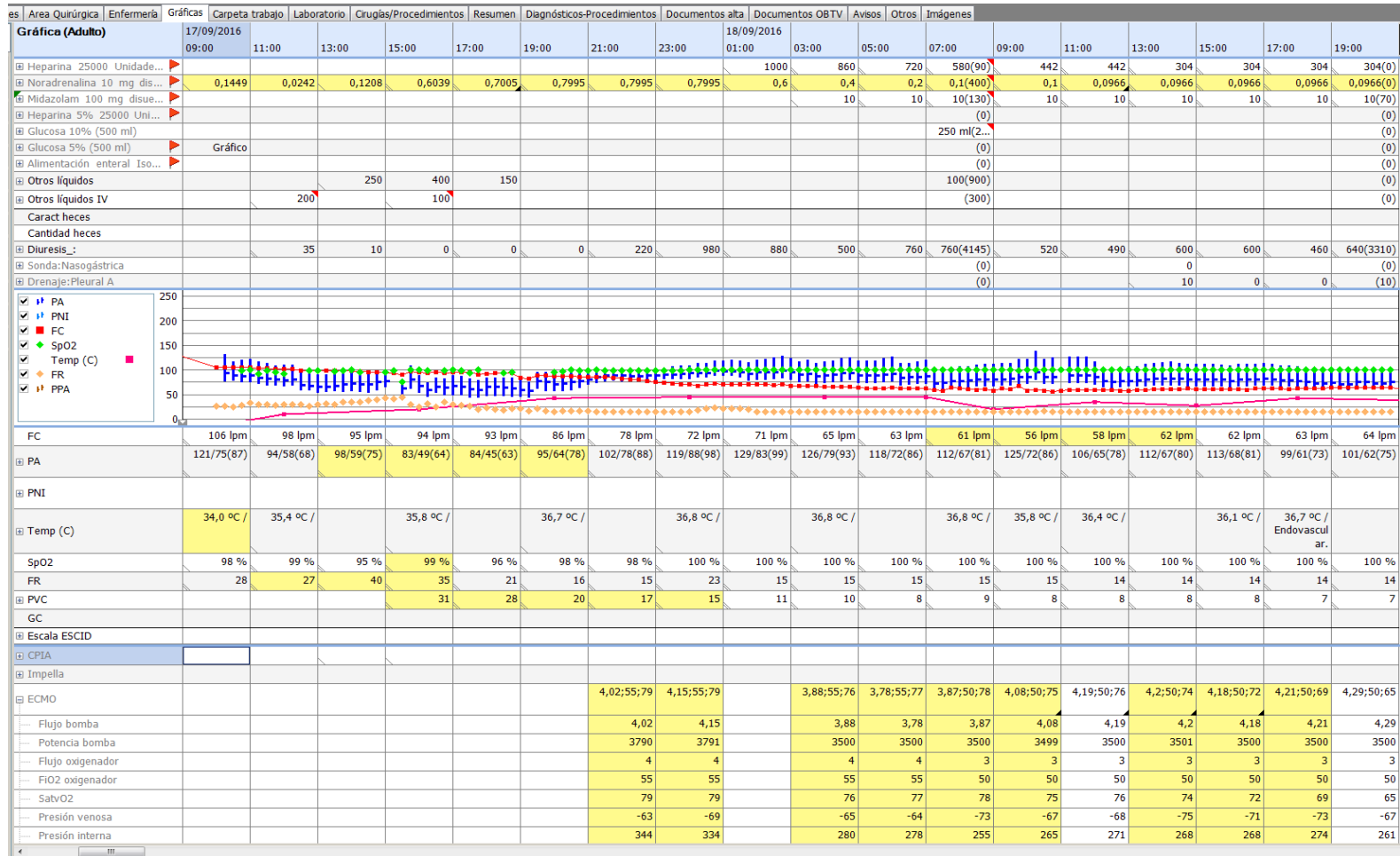
Lund et al. ISHLT 33rd Adult Heart Transplantation Report

F. González-Vílchez et al. Rev Esp Cardiol. 2016;69(11):1071–1082



Our experience ...

Mechanical circulatory devices or Clinical profile?





Our experience ...

Mechanical circulatory devices or Clinical profile?

BIOQUIMICA-Suero/Plasma (A.C.)		
Glucosa	129.0	mg/dL
Urea	111.0	mg/dL
Creatinina	4.0	mg/dL
Sodio	139.0	mEq/L
Potasio	5.1	mEq/L
Acido Láctico(plasma)	214.6	mg/dL



BIOQUIMICA-Suero/Plasma (A.C.)			
Glucosa	126.0	mg/dL	[70.0 - 110.0]*
Urea	123.0	mg/dL	[10.0 - 50.0]*
Creatinina	3.72	mg/dL	[0.7 - 1.3]*
Sodio	138.0	mEq/L	[135.0 - 145.0]
Potasio	4.1	mEq/L	[3.51 - 5.0]
Proteinas Totais	5.7	g/dL	[6.0 - 8.0]*
Calcio	7.6	mg/dL	[8.5 - 10.1]*
Bilirrubina Total	3.4	mg/dL	[0.2 - 1.0]*
GOT (AST)	18566.0	UI/L	[5.0 - 40.0]*
GPT (ALT)	9932.0	UI/L	[16.0 - 63.0]*
Amilasa	163.0	UI/L	[28.0 - 100.0]*
CPK	610.0	UI/L	[39.0 - 308.0]*
NT-proBNP	>35000.00 [Valor Ref.: 12.00-125.00]		
Acido Láctico(plasma)	69.45	mg/dL	[3.6 - 18.0]*

GASOMETRÍA (A.C.)		
Tipo de mostra solicitada	Arterial	
GASOMETRÍA-Valores de gases en sangre (A.C.)		
pH	7.56	
pCO2	33.0	mmHg
pO2	224.0	mmHg
GASOMETRÍA-Valores de Oximetría (A.C.)		
Saturación de Oxígeno	99.9	%
GASOMETRÍA-Estado Acido-Base (A.C.)		
Exceso de base efectivo	7.2	mMol/L
Bicarbonato estandar plasma	31.5	mMol/L
Hematocrito	34.0	%
Concentración total Hemoglobina	10.9	g/dl
Potasio	3.9	mEq/L
Sodio	134.0	mEq/L
Calcio iónico	0.88	mMol/L
Cloro	87.0	mEq/L
Bicarbonato plasma	29.9	mMol/L
Exceso de base	7.6	mMol/L
Concentración total de Oxígeno	15.8	Vol%
Concentración total CO2	31.0	mMol/L

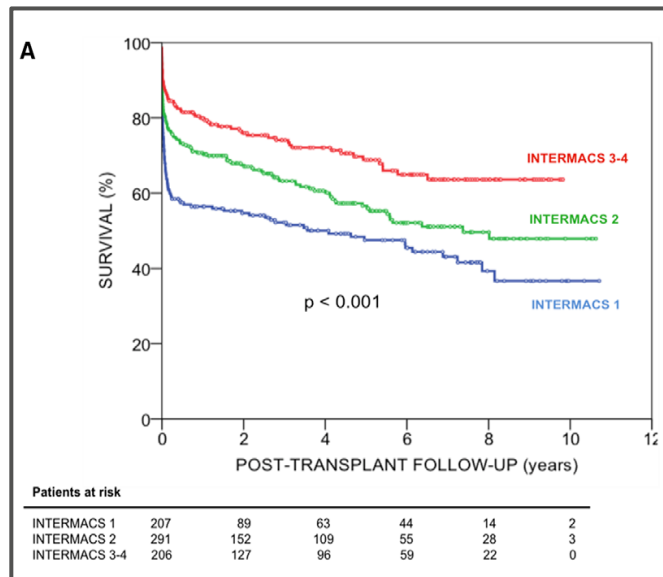


Our experience ...

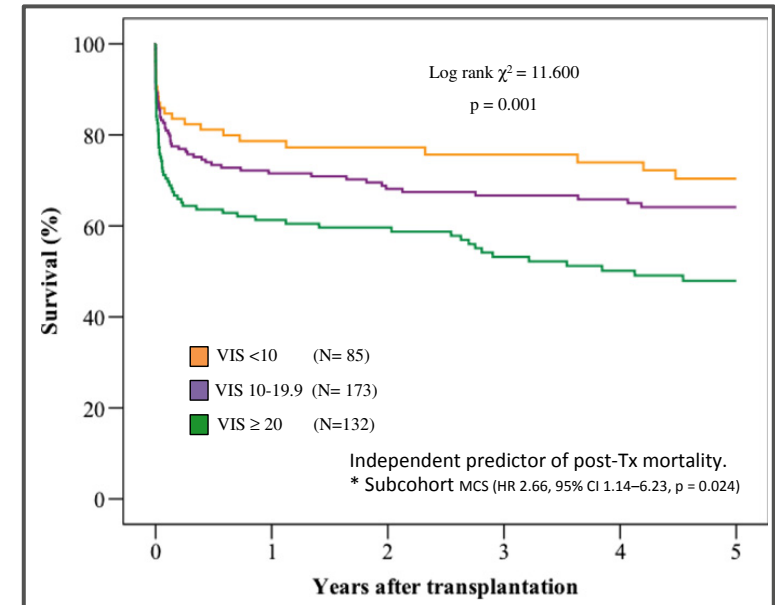
Mechanical circulatory devices or Clinical profile?

- Preoperative VIS and INTERMACS profile

Long-term survival after heart transplantation. **A**, Entire cohort. **B**, Patients discharged alive from hospital after heart transplantation.



Preoperative VIS and post-transplant mortality. Multi-variable analysis HR 1.005, 95% CI 1.002–1.008, $p < 0.001$



Kaplan–Meier post-transplant survival curves in patients with a preoperative VIS b 10, 10–19.9 and ≥ 20 , as compared by means of the log-rank test. VIS, vasoactive-ino- tropic score.

Barge-Caballero et al. Circ Heart Fail. 2013;6:763-772.)

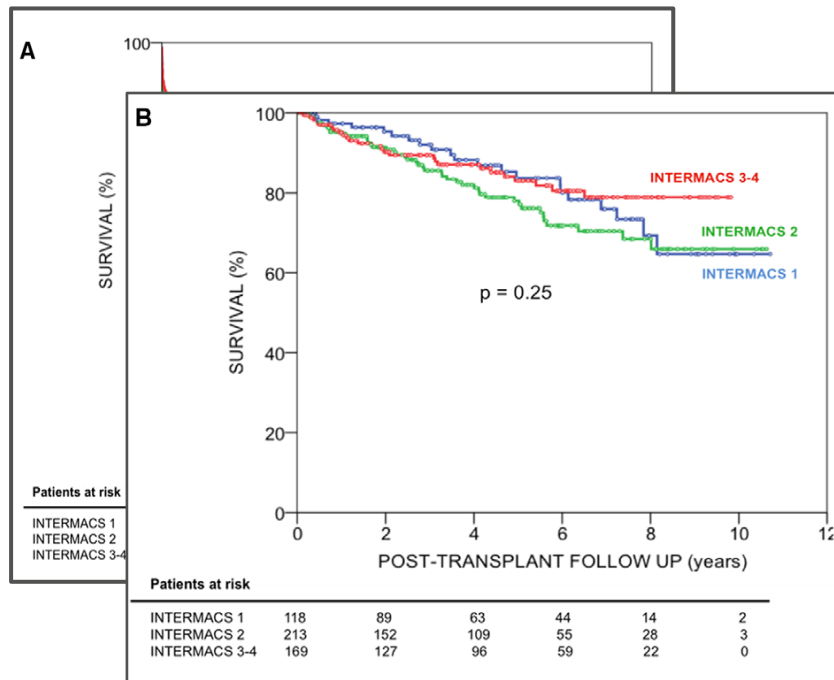


Our experience ...

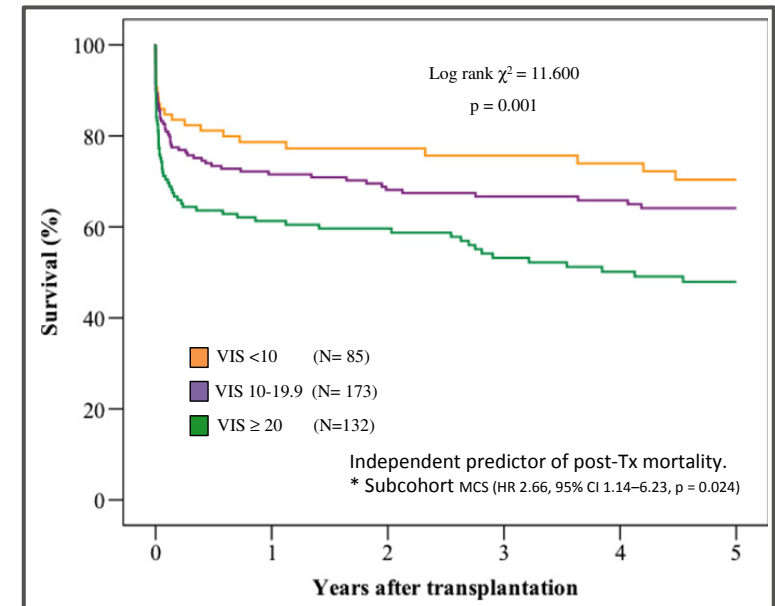
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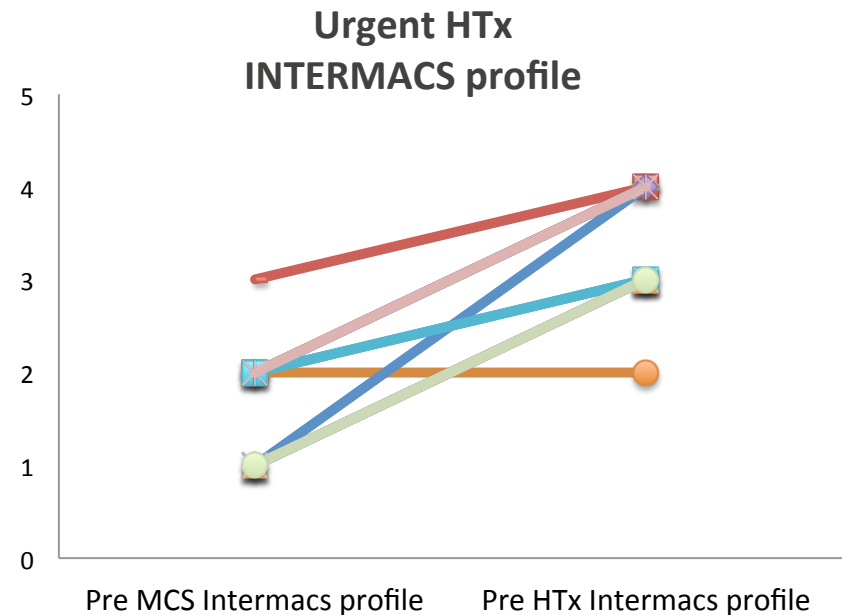
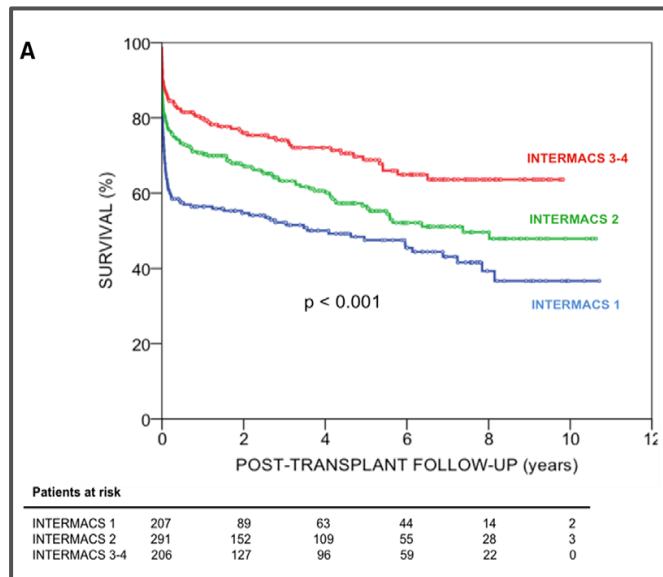


Our experience ...

Mechanical circulatory devices or Clinical profile?

- Preoperative VIS and INTERMACS profile

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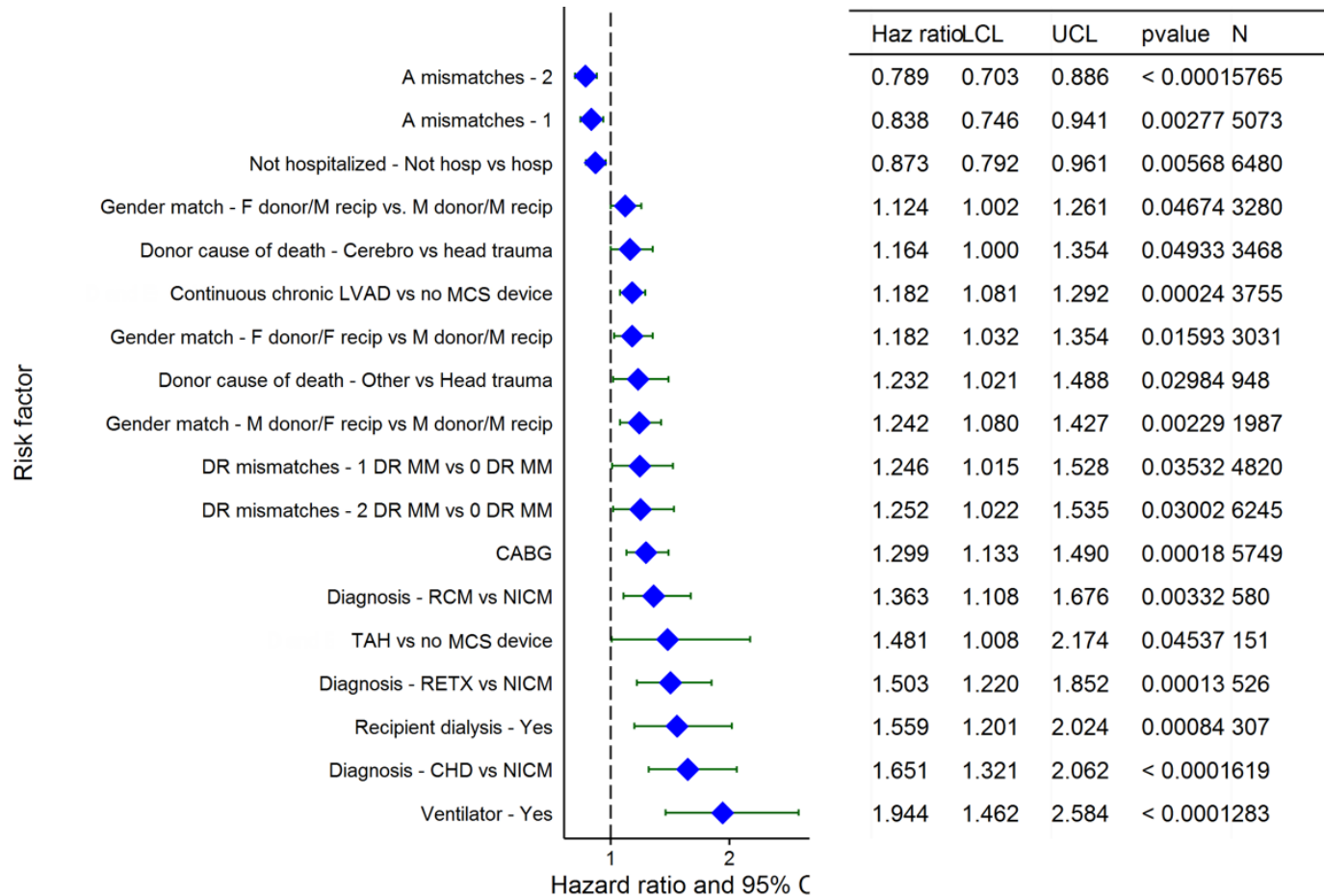
Time Support to list: 2,2 (0-8) days

Barge-Caballero et al. Circ Heart Fail. 2013;6:763-772.)



Our experience ...

Risk Factors For 1 Year Mortality with 95% Confidence limits



(N = 19,948)



Our experience ...

Risk Factors For 1 Year Mortality with 95% Confidence limits

- Mechanical ventilation

Patient	Sex	Age	Heart Condition	Acute or Chronic	INTERMACS profile	Short-Term MCS device	Time support	MV days	Free MV days during support	MV days post HTx	ICU stay	ICU stay after HTx	Outcome
1	Woman	37	IDC	Acute HF	1	Periph VA ECMO	16	21	0	4	24	7	Alive
2	Man	36	Becker	ADCHF	2	Impella 2.5 Fem	6	17	6	17	37	18	Alive
3	Man	47	Ischemic	Acute HF	1	Periph VA ECMO	11	41	0	27	50	34	Alive
4	Man	53	Ischemic MC	Acute HF	1	Periph VA ECMO	12	19	0	5	24	13	Alive
5	Man	57	IDC	ADCHF	2*	Axillary VA ECMO	10	14	2	7	16	7	Died
6	Man	53	ARVD	ADCHF	2	Impella CP Fem	8	2	8	2	35	20	Alive
7	Man	39	Ischemic	Acute HF	1	Periph VA ECMO	13	18	0	5	20	7	Alive
8	Man	68	Ischemic	Acute HF	3**	Axillary Impella CP	5	4	5	4	58	9	Alive
9	Man	65	IDC	ADCHF	2	Axillary Impella CP	20	1	20	1	55	6	Alive
10	Man	55	IDC	ADCHF	2	Axillary Impella CP	12	4	12	4	46	12	Alive
11	Man	47	Ischemic	Acute HF	2	Impella CP Fem	14	35	0	12	49	22	Alive
12	Man	41	IDC	ADCHF	1	Periph VA ECMO	15	21	14	10	30	15	Alive
13	Man	42	I. Endocarditis	Acute HF	1	Periph VA ECMO	43	45	11	15	65	15	Alive
14	Man	56	IDC	ADCHF	2	Axillary Impella CP	10	1	10	1	18	4	Alive
15	Man	65	IDC	ADCHF	1	Periph VA ECMO	10	23	0	12	61	45	Alive



Our experience ...

Continuous Risk Factors For 1 Year post-HTx Mortality

Adult Heart Transplants (2009-6/2014)

- Recipient age
- Recipient creatinine
- Donor height
- Transplant center volume
- Donor age
- Ischemia time
- Recipient BSA
- Recipient total bilirubin

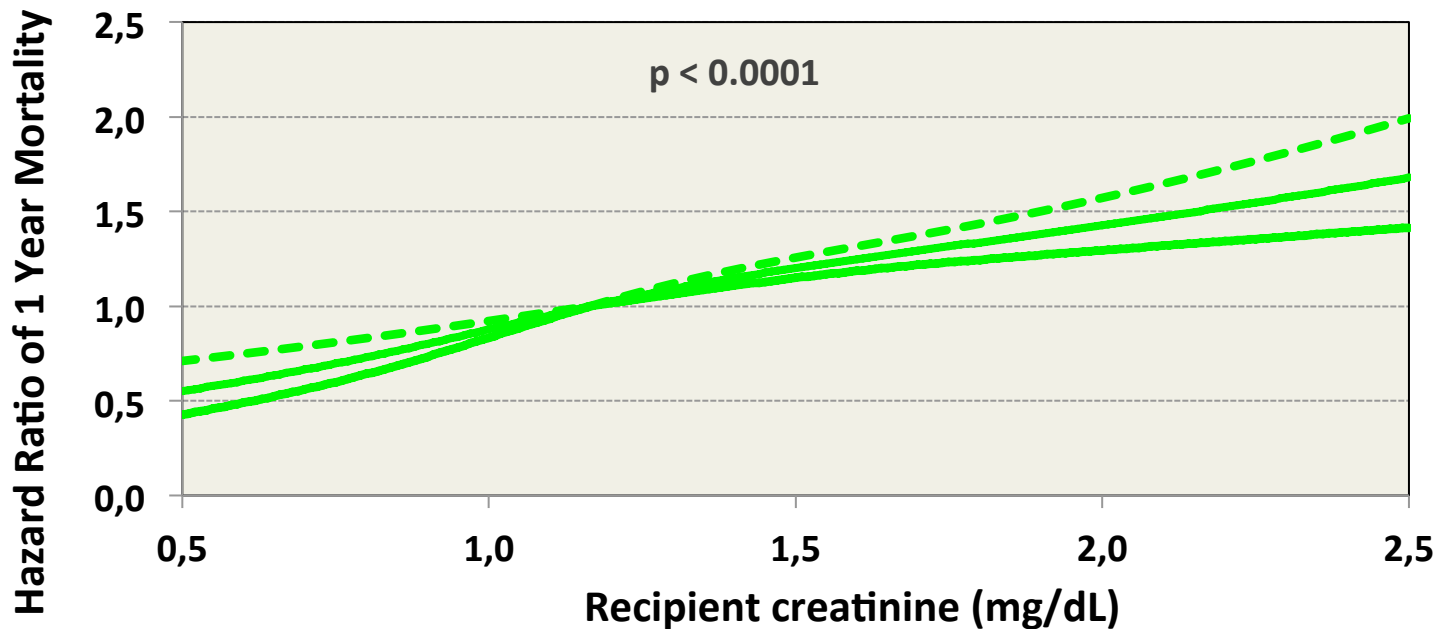




Our experience ...

Continuous Risk Factors For 1 Year post-HTx Mortality

- Recipient creatinine and Total bilirubin

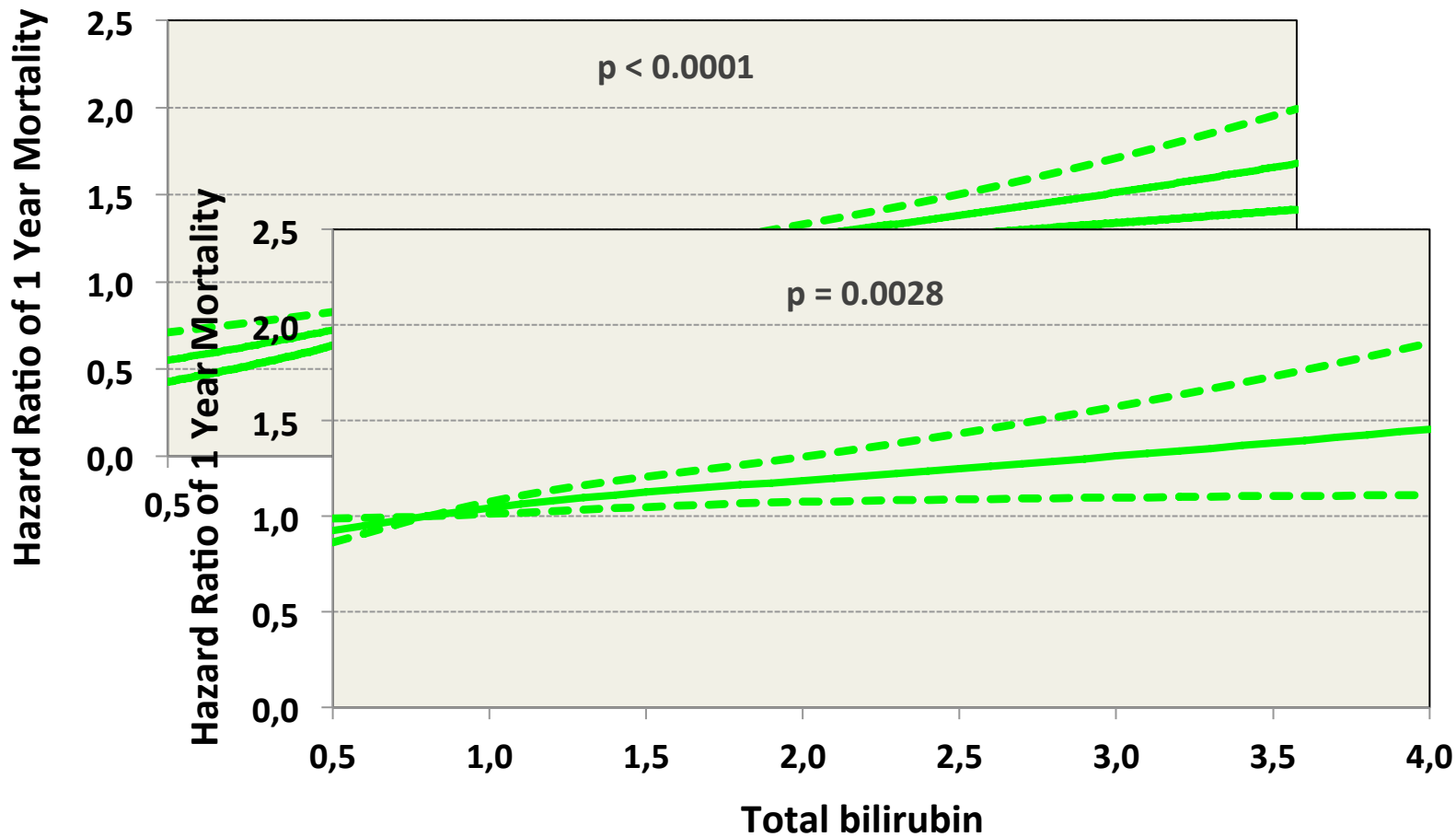




Our experience ...

Continuous Risk Factors For 1 Year post-HTx Mortality

- Recipient creatinine and Total bilirubin





Our experience ...

Continuous Risk Factors For 1 Year post-HTx Mortality

- Recipient creatinine and Total bilirubin

End-organ recovery is key to success for ECMO as a bridge to Heart transplantation or implantable LVAD

	Before ECLS	Before VAD	P-value
Creatinine (mg/dl)	1.86 ± 0.91	1.32 ± 0.52	0.02
MDRD-GFR (ml/min/1.78 m ²)	48.73 ± 26.64	66.26 ± 28.33	0.01
Bilirubin (mg/dl)	2.03 ± 1.30	3.08 ± 2.13	0.05
Aspartate aminotransferase (U/l)	1426 ± 2176	277 ± 259	0.04
Alanine aminotransferase (U/l)	982 ± 1466	357 ± 447	0.04
MELD-XI score (pts)	18.43 ± 7.72	16.08 ± 8.59	0.05
FiO ₂ (%)	52 ± 18	26 ± 23	<0.01
Positive end-expiratory pressure (mbar)	7 ± 3	5 ± 4	0.02
Peak inspired pressure (mbar)	21 ± 4	17 ± 4	0.01
Noradrenaline (µg/kg/min)	0.408 ± 0.255	0.255 ± 0.097	0.01
Levosimendan (µg/kg/min)	0.056 ± 0.025	0.025 ± 0.01	0.01
Dobutamine (µg/kg/min)	4.362 ± 1.8	1.8 ± 0.8	0.01
Haemoglobin (mg/dl)	11.1 ± 1.5	11.1 ± 1.5	0.99
Platelets (×10 ⁹)	166 ± 45	166 ± 45	0.99
C-reactive protein (mg/dl)	11.29 ± 4.5	11.29 ± 4.5	0.99
Leucocytes (×10 ⁹)	14.0 ± 4.5	14.0 ± 4.5	0.99

The use of temporary MCS should be strongly considered in patients with MOF, sepsis, or on mechanical ventilation to allow successful **optimization** of clinical status and neurologic assessment **prior to placement of a long term MCSD.** (Class I C)

Durinka et al. ASAIO J 2014;60(2):189-92

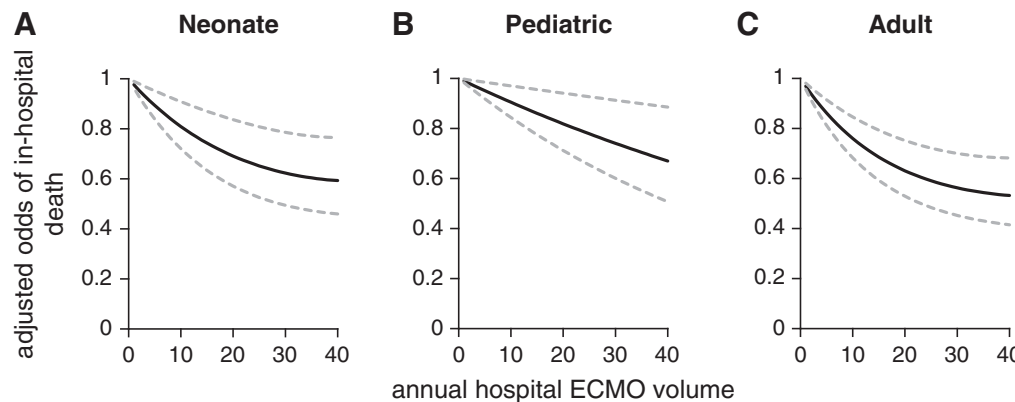
2013 ISHLT MCS Guidelines. Feldman et al. J Heart Lung Transplant 2013;32:157-187



Our experience ...

Continuous Risk Factors For 1 Year post-HTx Mortality

- Transplant center volume



Association of Hospital Level Volume of ECMO cases and Mortality

Period	Annual Hospital ECMO Volume	Adjusted Mortality Odds Ratio (95% CI)		
		Neonate	Pediatric	Adult
1989–2013	1–5	Referent	Referent	Referent
	6–14	0.86 (0.75–0.98)	0.99 (0.86–1.13)	0.81 (0.66–0.995)
	15–30	0.74 (0.63–0.88)	0.86 (0.73–1.01)	0.75 (0.59–0.94)
	>30	0.69 (0.56–0.84)	0.89 (0.69–1.14)	0.61 (0.48–0.79)
2008–2013	1–5	Referent	Referent	Referent
	6–14	1.01 (0.79–1.28)	1.03 (0.84–1.25)	0.82 (0.64–1.05)
	15–30	0.94 (0.70–1.25)	0.92 (0.73–1.16)	0.72 (0.55–0.96)
	>30	0.65 (0.42–1.01)	0.85 (0.57–1.28)	0.61 (0.46–0.80)

Barbaro RP et al. AJRCCM 2015;191:894-901

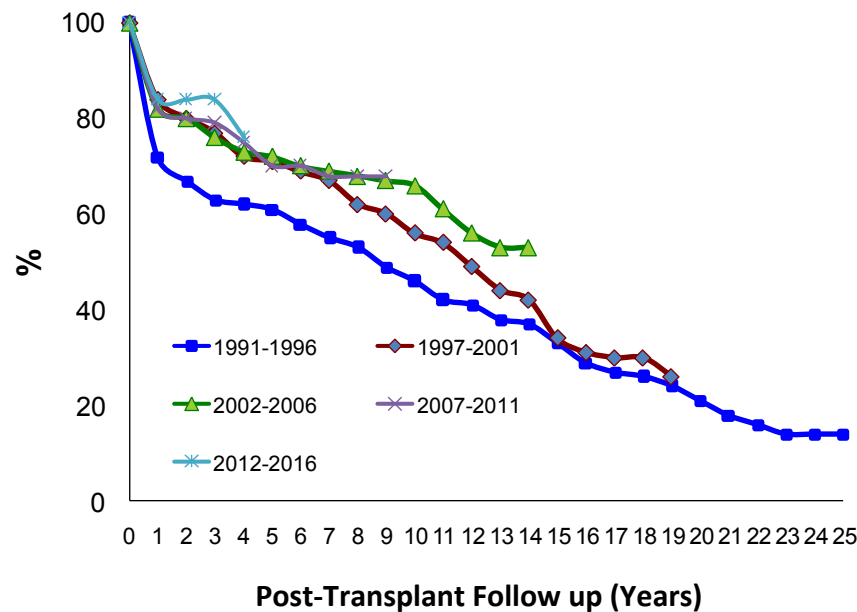


Our experience ...

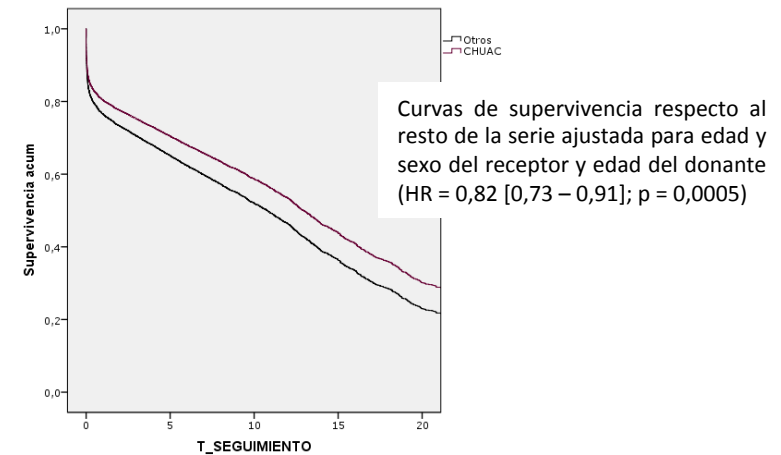
Continuous Risk Factors For 1 Year post-HTx Mortality

- Transplant center volume

CHUAC Heart Transplants (1991/2016)



Kaplan-Meier long-term survival after adult heart transplantation by era.



	CHUAC	Resto
1º año	83,1 ± 1,5	75,7 ± 0,6
5º año	70,4 ± 1,9	64,6 ± 0,6
10º año	58,9 ± 10,1	51,8 ± 0,7
15º año	42,5 ± 2,4	37,0 ± 0,8
Mediana supervivencia	12,4 (11,1 - 13,7)	10,8 (10,3 - 11,3)

P=0.02

Conclusions



- **In-hospital mortality in CS remain very high**
- **Hub and Spoke network model is necessary to optimize resources and outcome**
- **Short-term MCS devices are useful in Refractory CS, but optimal timing and device selection are under investigation**
- **Appropriate timing for Heart Transplantation: Improve clinical profile, end-organ recovery, rehabilitation, nutrition ... Is associated with better prognosis**
- **Galician transplant program: Success results.**



Thanks

Five years of the interhospital management protocol of cardiogenic shock in Galicia.