

My Favorite Approach for Ventricular Tachycardia Ablation in Patients with Ischemic Heart and Low EF

Professor Shih-Ann Chen

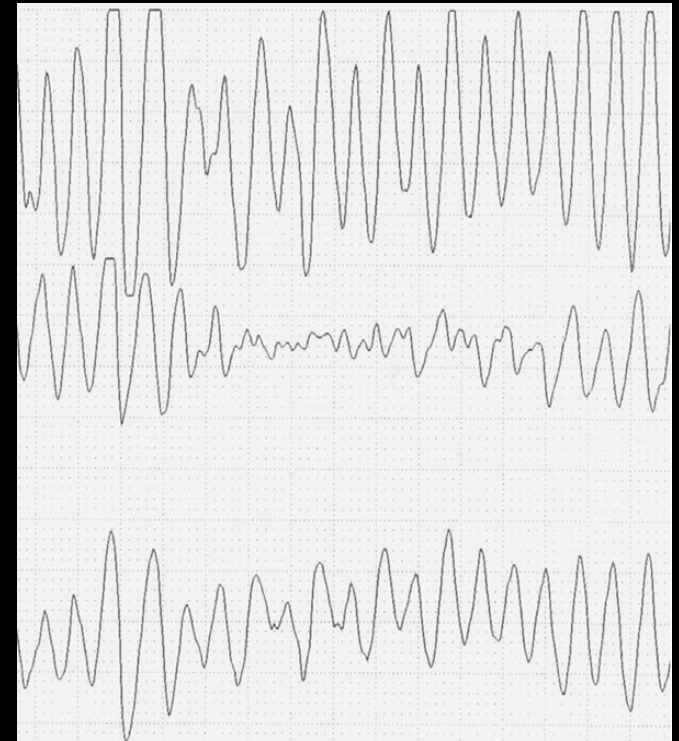
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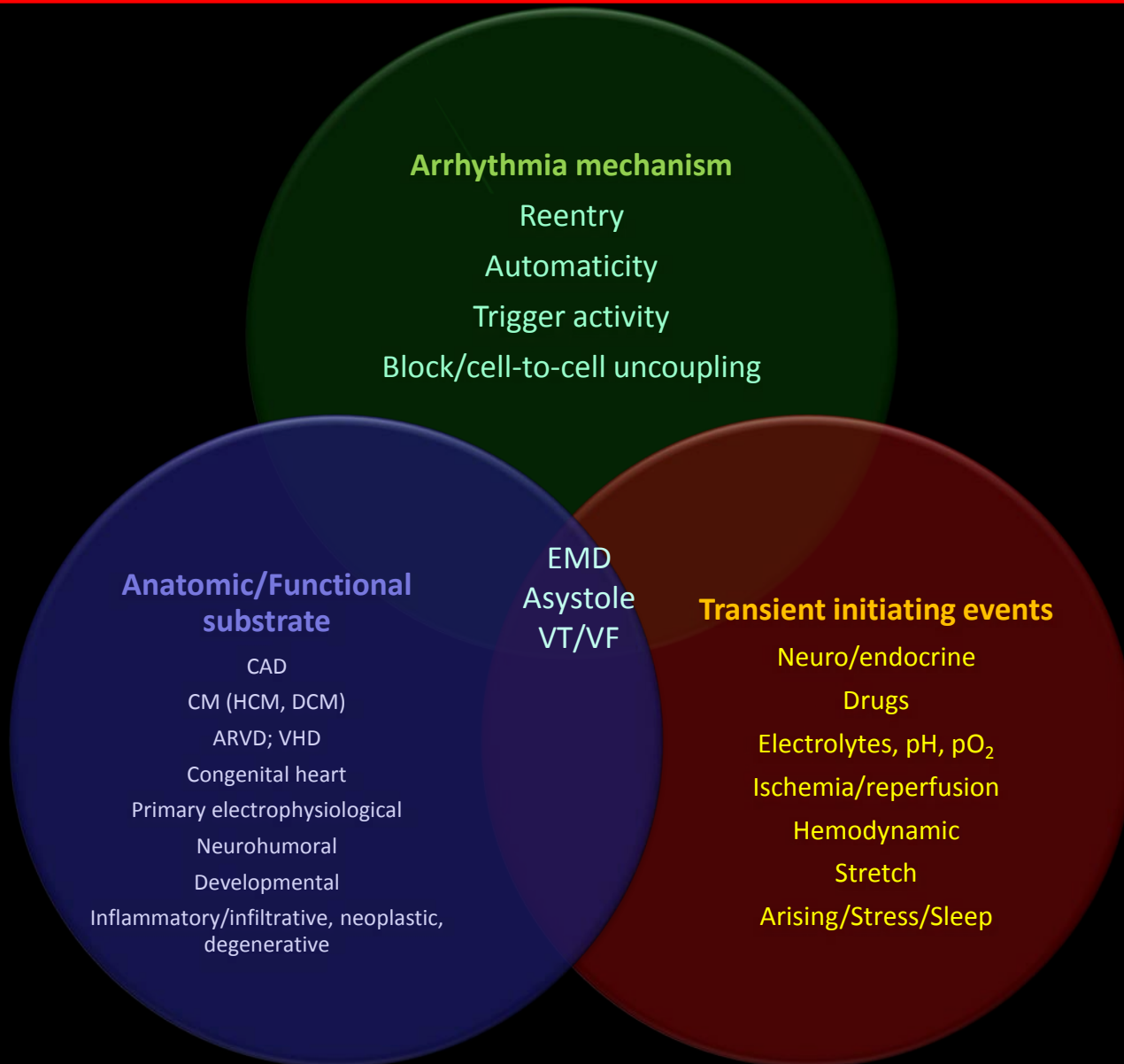


Electrical Storm

- Three distinct episodes of sustained VT or VF within the last 24 hours
- Occurrence of incessant VT for at least 12 hours
- ≥ 3 shocks in the last 24 hours (separated by ≥ 5 min)



The Development of Electrical Storm



Nature Entity of Electrical Storm: Clustering and Unpredictable

Type	ATP Seq	Shocks	Success	ID#	Date	Type	ATP Seq	Shocks	Success	ID#	Date	
FVT	3	35J	Yes	65	05-Jul-2018	VT-Mon					38	16-Jan-2018
----- Last Programmer Session 28-Jun-2018						VT	1		Yes		37	16-Jan-2018
VT	6	35J	Yes	64	02-Mar-2018	VT-Mon					36	16-Jan-2018
VT-Mon				63	02-Mar-2018	VT	2		Yes		35	16-Jan-2018
VT-NS				62	02-Mar-2018	VT	1		Yes		34	16-Jan-2018
VT	4	35J	Yes	61	23-Feb-2018	VT-Mon					33	16-Jan-2018
FVT	1	35J	Yes	60	22-Feb-2018	VT	1		Yes		32	16-Jan-2018
VT	6	35J	Yes	59	22-Feb-2018	VT	1		Yes		31	16-Jan-2018
VT	0			58	26-Jan-2018	VT	2		Yes		30	16-Jan-2018
VT-NS				57	26-Jan-2018	VT	1		Yes		29	16-Jan-2018
VT-NS				56	26-Jan-2018	VT	2		Yes		28	16-Jan-2018
VT-NS				55	26-Jan-2018	VT	4		Yes		27	16-Jan-2018
VT-NS				54	26-Jan-2018	VT	1		Yes		26	16-Jan-2018
VT	0			53	26-Jan-2018	VT	4		Yes		25	16-Jan-2018
VT-NS				52	26-Jan-2018	VT	4		Yes		24	16-Jan-2018
VT-NS				51	26-Jan-2018	VT	1		Yes		23	15-Jan-2018
VT-NS				50	26-Jan-2018	VT	3		Yes		22	15-Jan-2018
VT	0			49	26-Jan-2018	VT	1		Yes		21	15-Jan-2018
VT-NS				48	26-Jan-2018	VT	3		Yes		20	15-Jan-2018
VT-NS				47	26-Jan-2018	VT	3		Yes		19	15-Jan-2018
VT-NS				46	26-Jan-2018	VT	2		Yes		18	15-Jan-2018
VT-NS				45	26-Jan-2018	VT	1		Yes		17	15-Jan-2018
VT	0			44	26-Jan-2018	VT	3		Yes		16	15-Jan-2018
VT-NS				43	26-Jan-2018	VT	1		Yes		15	15-Jan-2018
VT-NS				42	26-Jan-2018	VT	1		Yes		14	15-Jan-2018
VT-NS				41	26-Jan-2018	VT	2		Yes		13	15-Jan-2018
						VT	1		Yes		13	15-Jan-2018

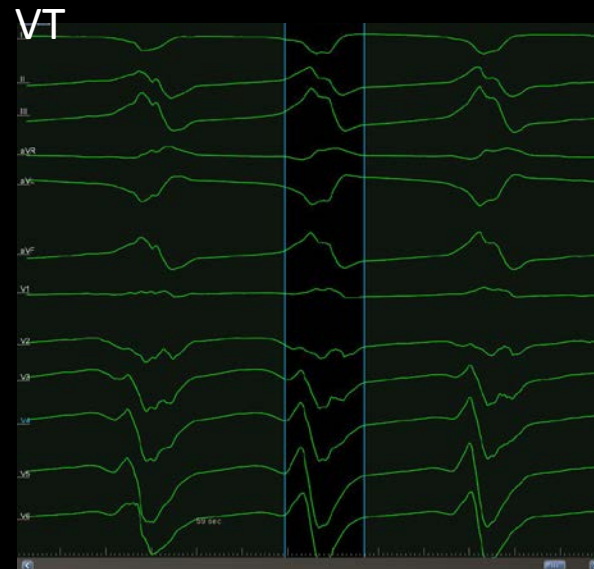
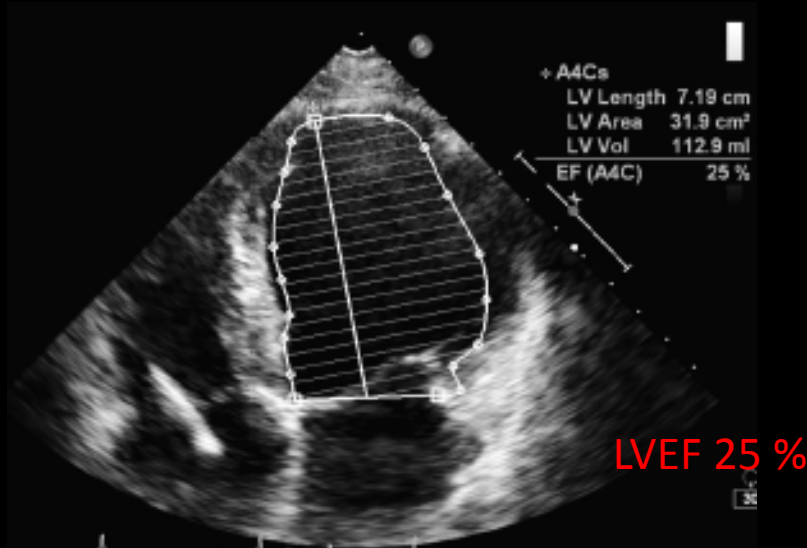
Case: Electric storm with left ventricular assist device



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Patient information

- 45-years-old male
 - Dilated cardiomyopathy → VT/VF → CPR → ICD on 2007
 - Frequent ICD shock for VT, electric storm → Heart transplant evaluation (2009) → Ablation



LV Catheter ablation (2009)

0.5mV Bipolar 1.5mV

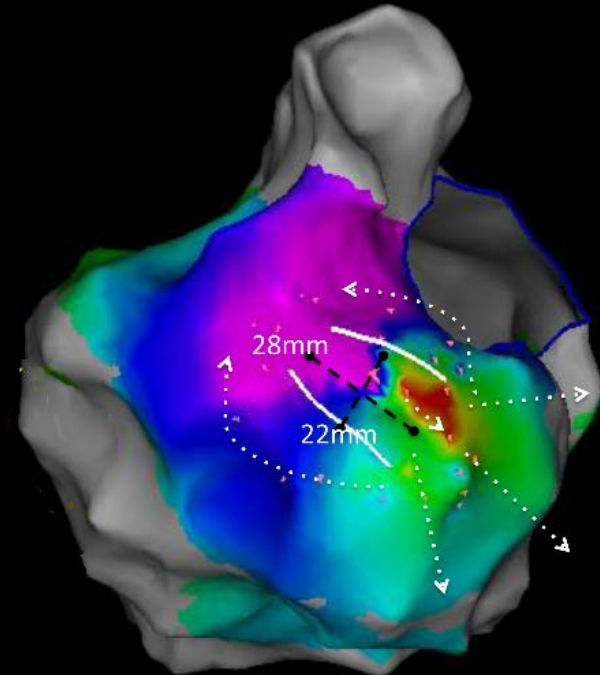
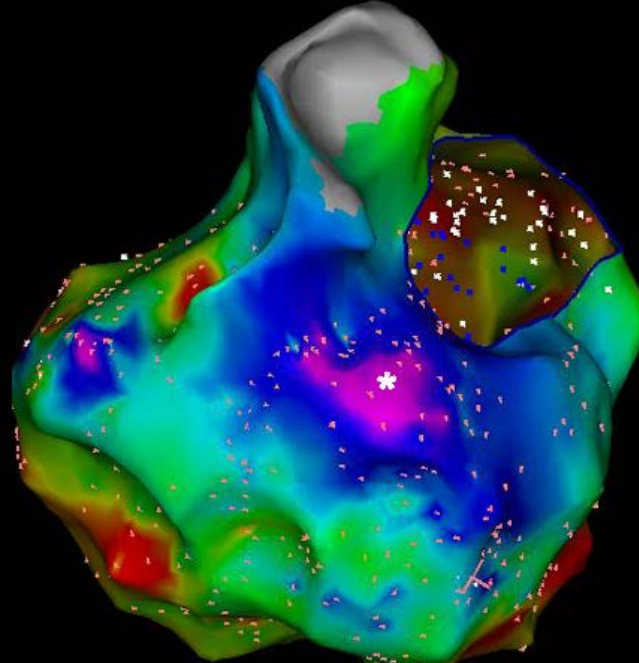
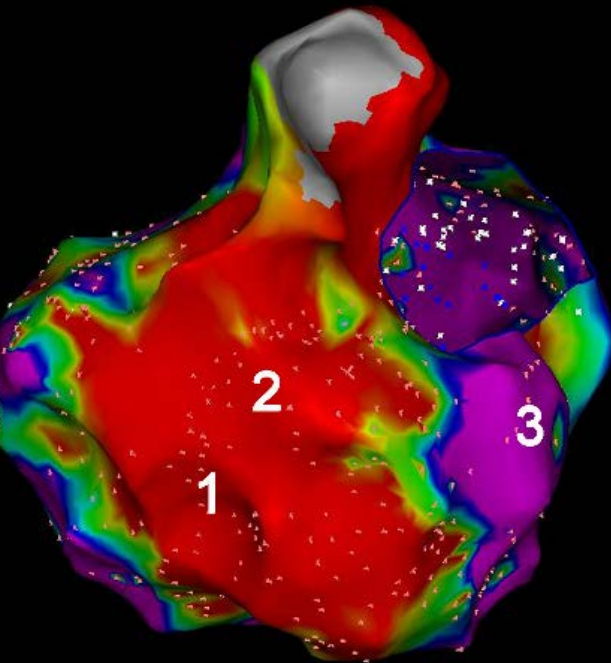
-17 LAT 124



Voltage Map

Late Potential Map

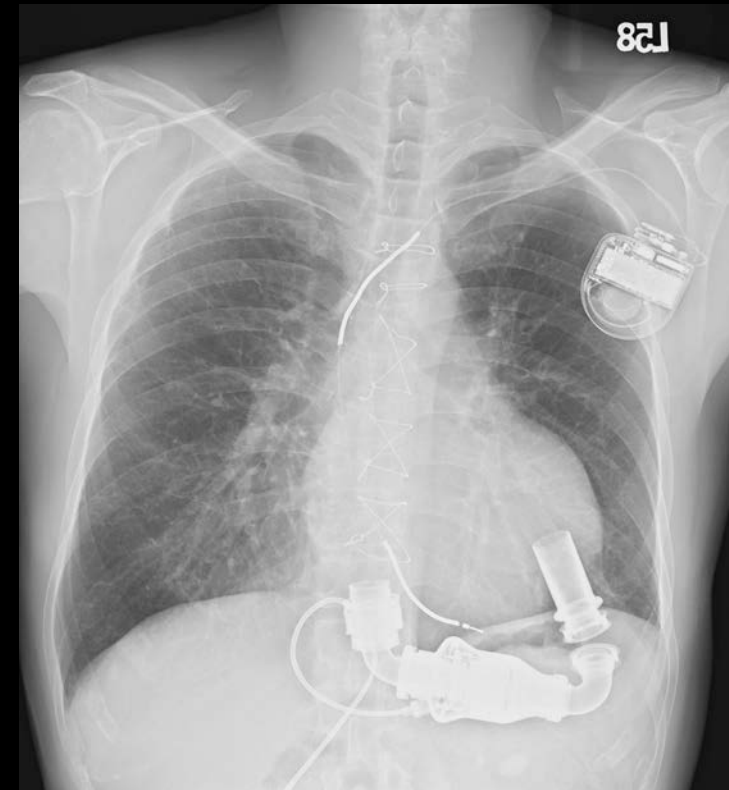
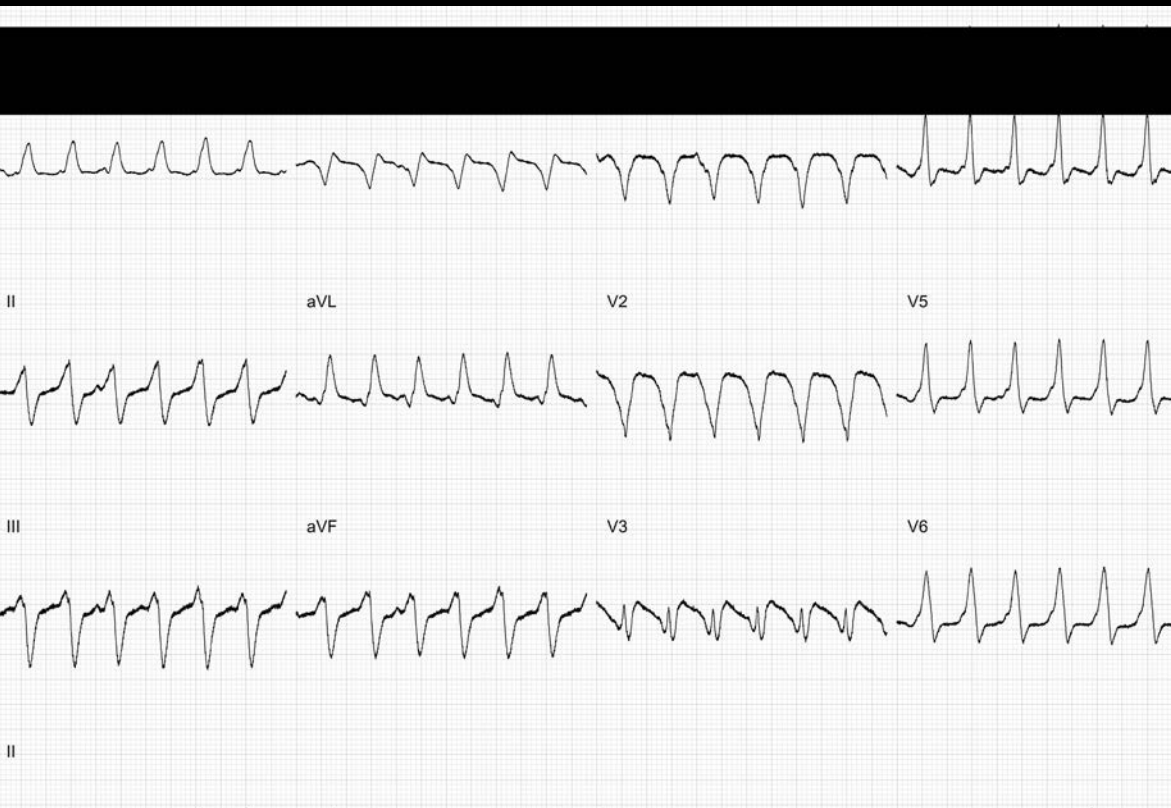
Activation Map



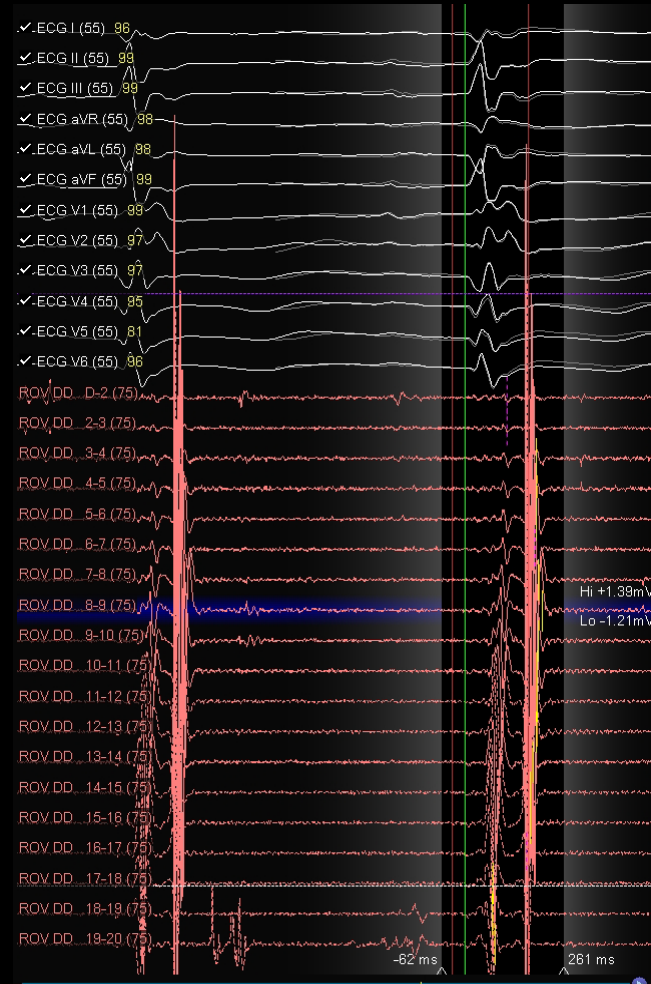
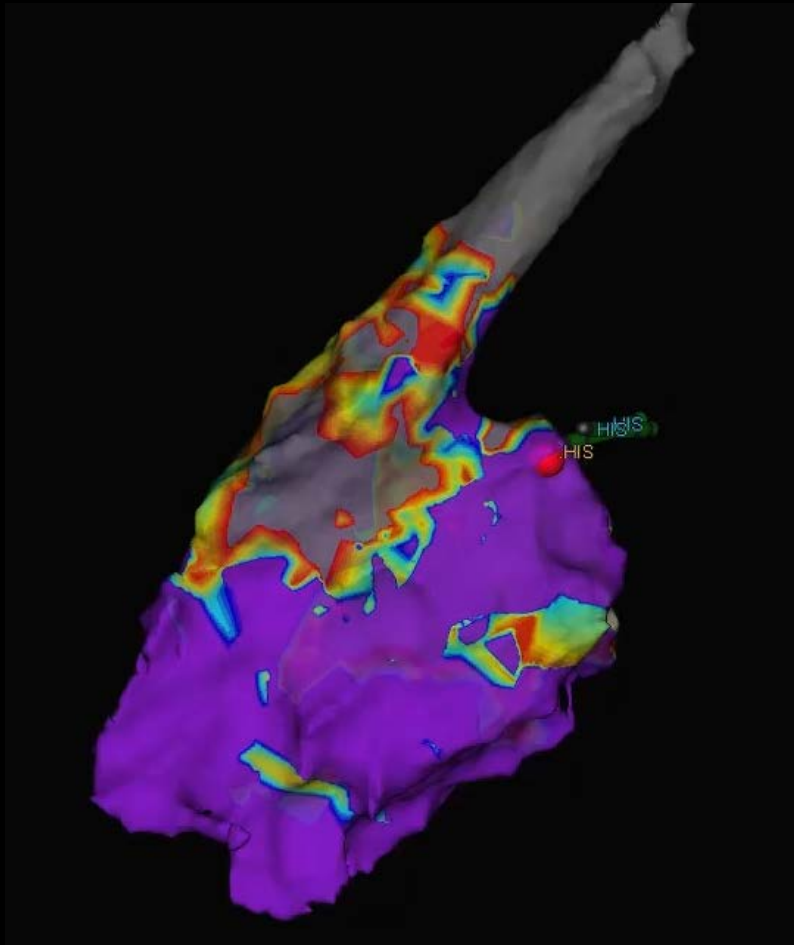
VT isthmus was identified and ablation eliminate VT

Stabilized heart function and no more electric storm until 2018

2018 VT Storm and Heart Stunning with LVAD Support



Abnormal fractionated signals in RV septum



No More Electric Storm After Ablation



The patient has more time for the heat transplantation!

Lesson From Electric Storm

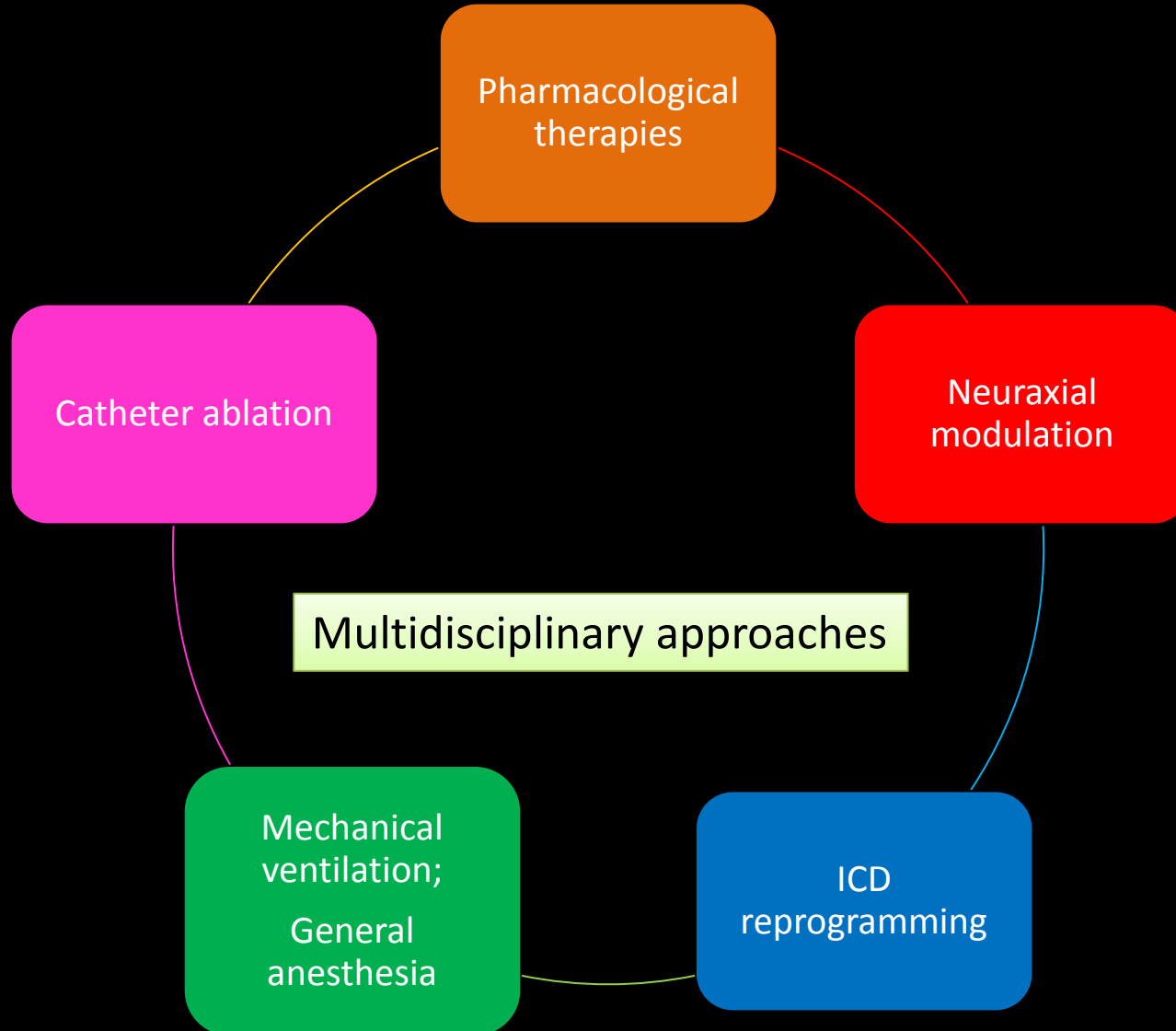
- Is it reversible?
 - Electrolyte imbalances,
 - Acute ischemia,
 - Pro-arrhythmic drug effects,
 - Hyperthyroidism,
 - Infections
 - Decompensated HF



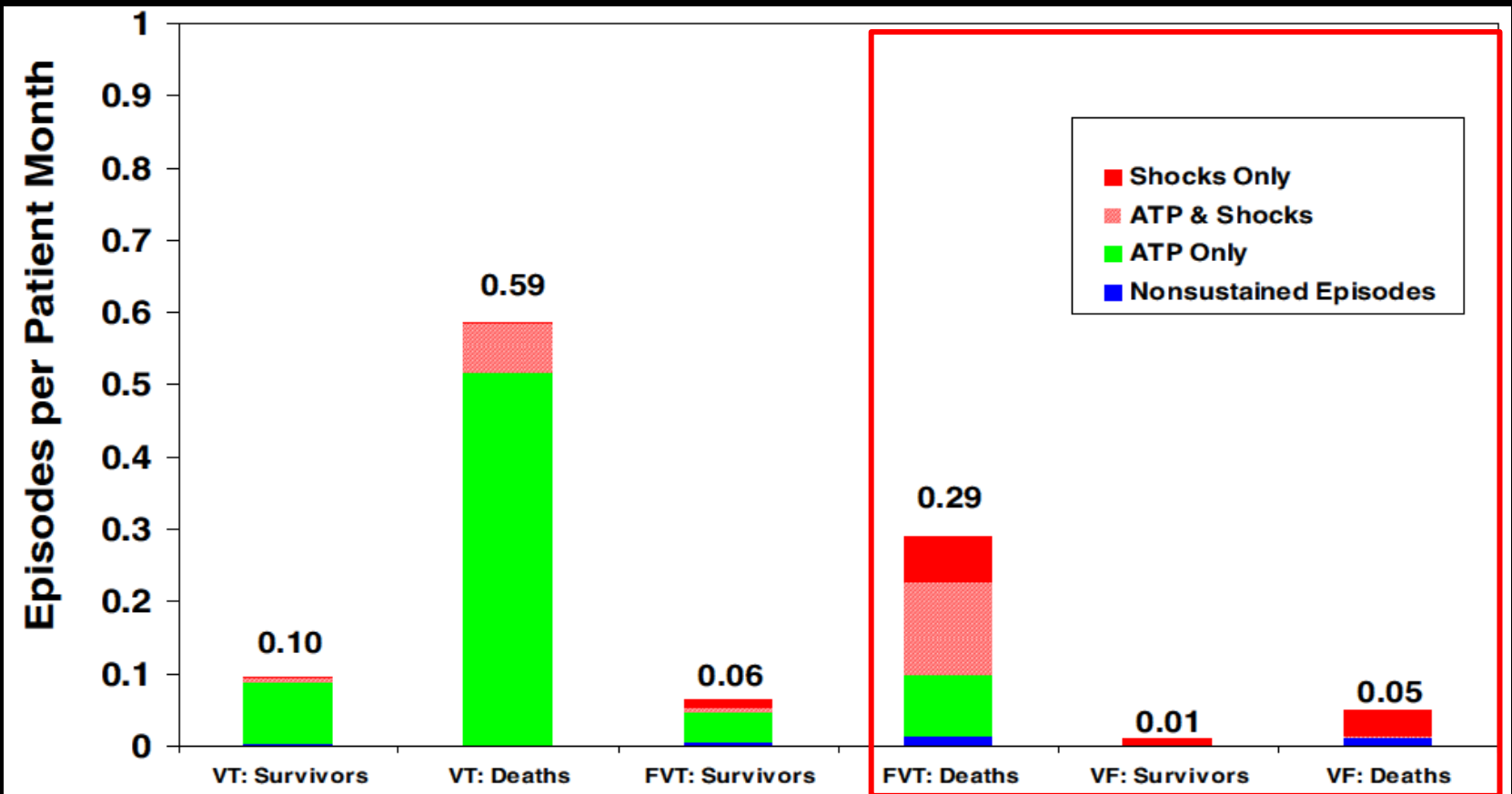
Less than 10 %

Reversible cause should be corrected

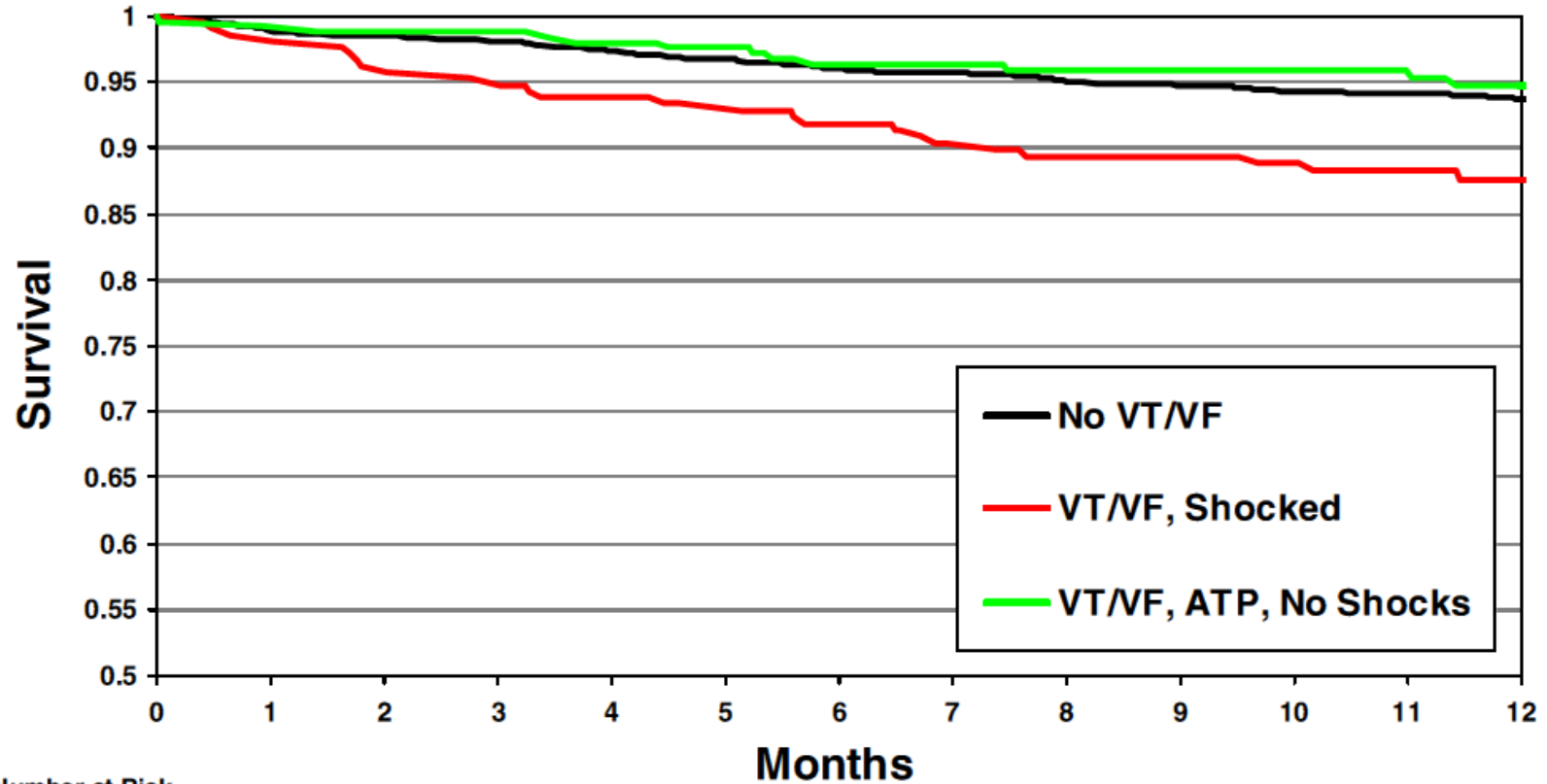
Management of electrical storm



The effects of ICD shocks on mortality

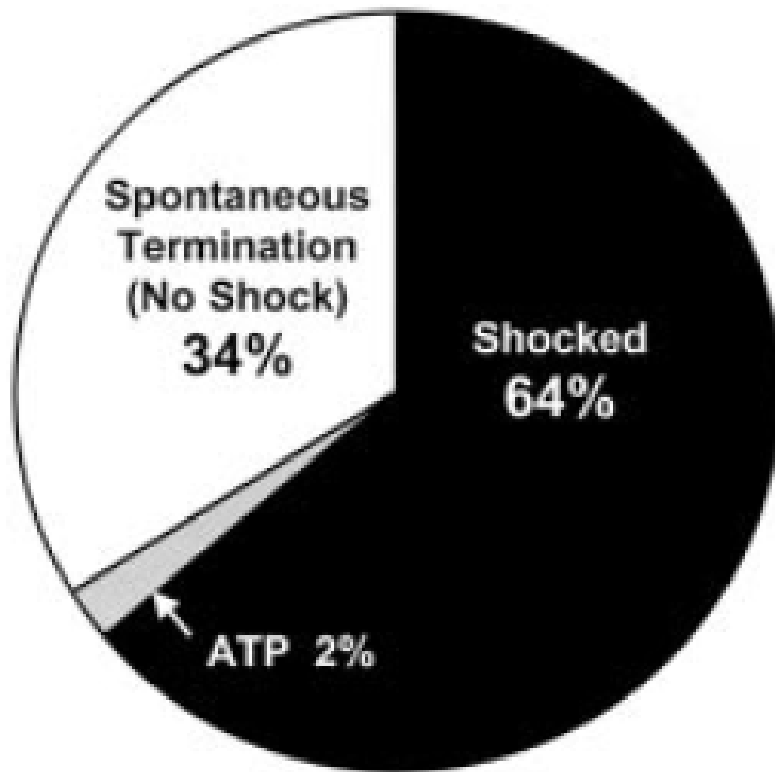


ICD shocks contribute to worse mortality

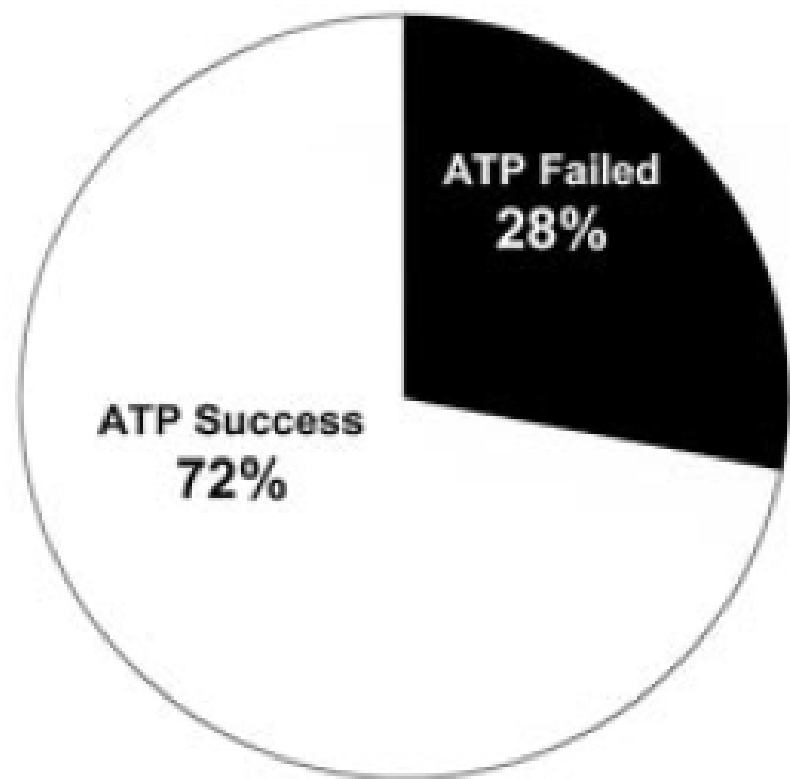


Number at Risk				
	0	1	2	3
No VT/VF (N=1671)	1584	1472	1355	812
VT/VF, Shocked (N=211)	201	186	172	97
VT/VF, ATP, No Shocks (N=253)	247	229	206	126

ATP Reduced ICD Shocks

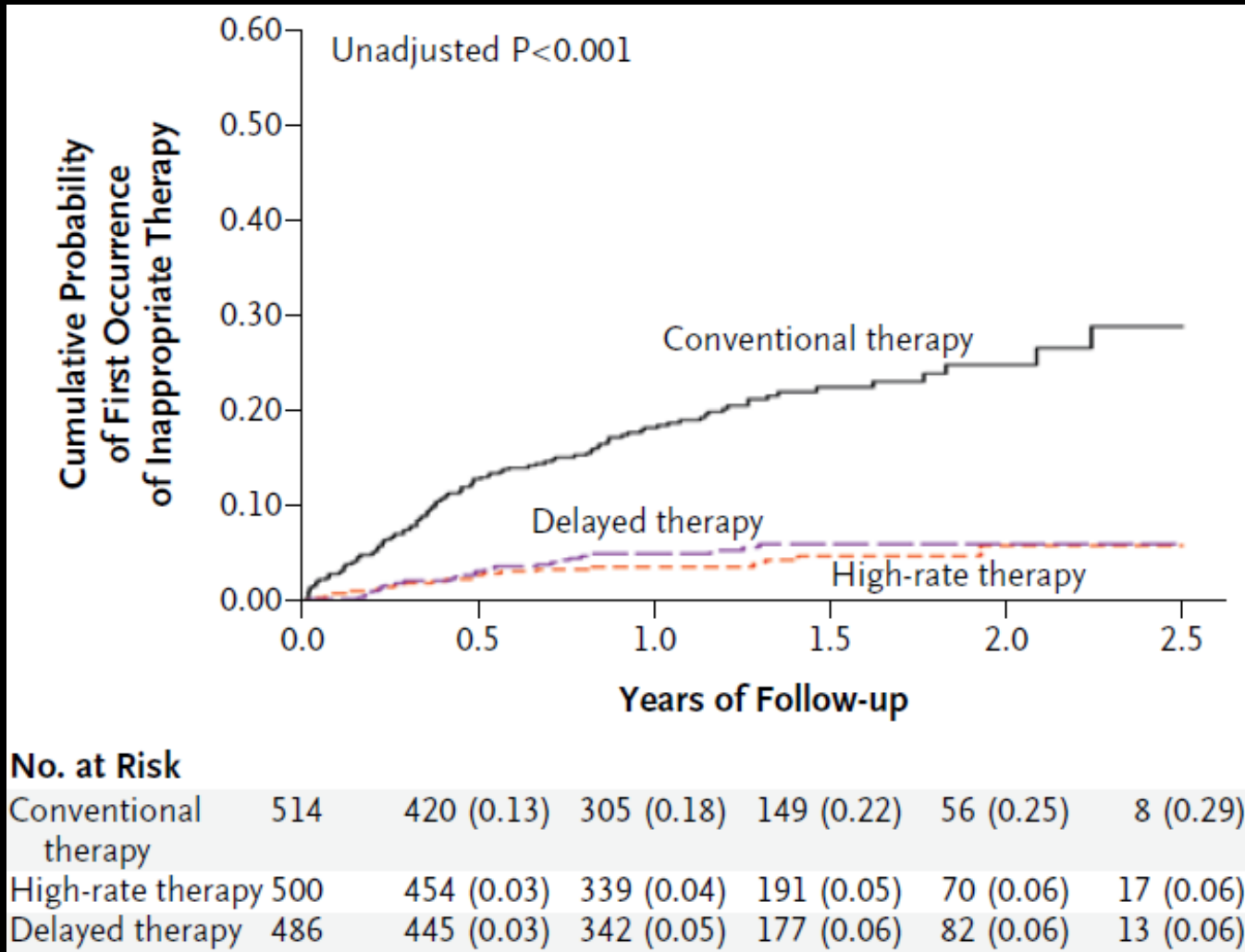


Shock Arm
(n=147 episodes)

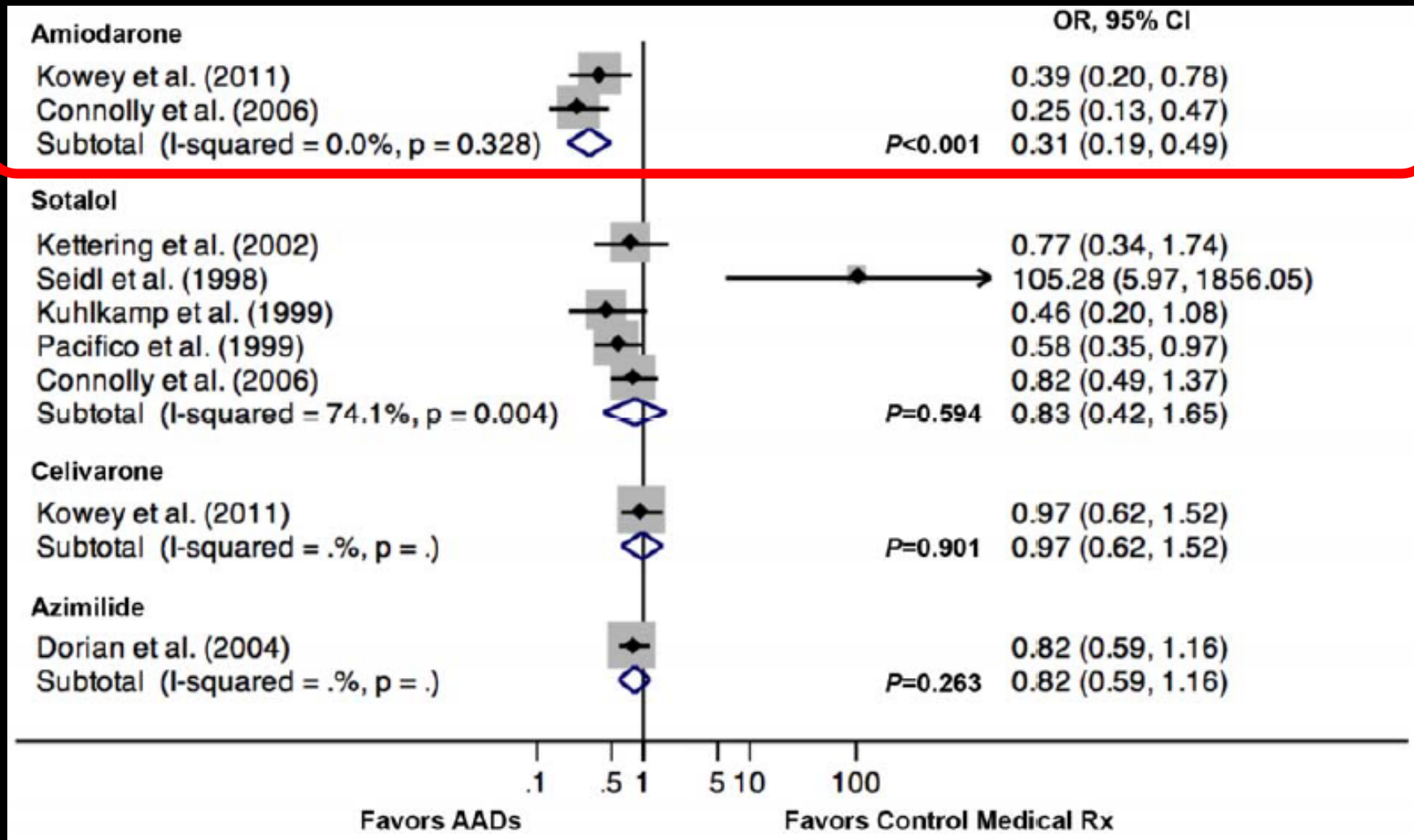


ATP Arm
(n=284 episodes)

Delayed Therapy Reduced ICD shock

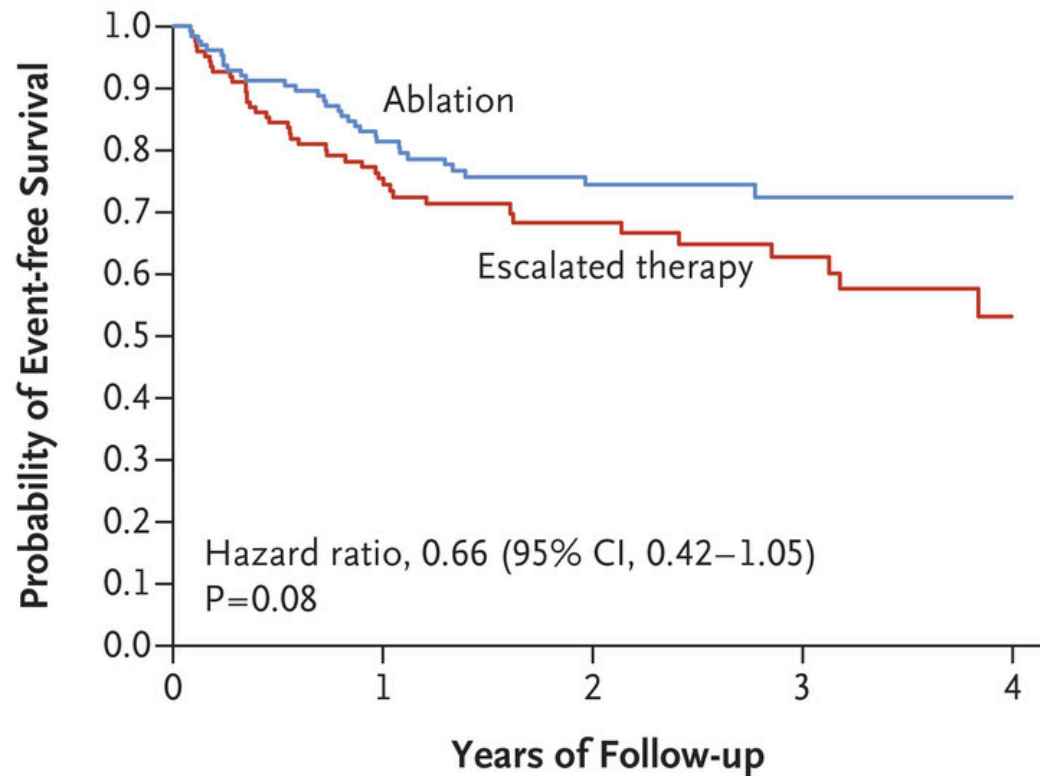


Amiodarone Reduced ICD Shocks



Ablation Better Than AAD for Electric Storm

C Ventricular Tachycardia Storm



No. at Risk

Ablation	132	95	53	34	13
Escalated therapy	127	77	40	28	9

Catheter Ablation for Electric Storm

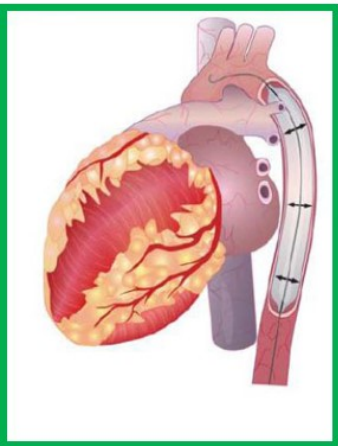
Ref.	No. of patients	Left ventricular ejection fraction	Epicardial procedures	Acute success	VT recurrence	ES recurrence	Death	Follow-up duration, mo
Sra <i>et al</i> ^[64]	19	27 ± 8	0%	87%	37%	-	0%	7 ± 2
Silva <i>et al</i> ^[65]	14	31 ± 13	20%	80%	13%	-	27%	12 ± 17
Carbucicchio <i>et al</i> ^[56]	95	36 ± 11	11%	89%	34%	8%	16%	Median 22
Arya <i>et al</i> ^[66]	13	33 ± 9	31%	100%	38%	-	31%	Median 23
Pluta <i>et al</i> ^[67]	21	-	0%	81%	19%	0%	0%	3
Deneke <i>et al</i> ^[68]	31	28 ± 15	9%	94%	25%	12%	9%	Median 15
Kozeluhova <i>et al</i> ^[69]	50	29 ± 11	0%	85%	52%	26%	29%	18 ± 16
Koźluk <i>et al</i> ^[70]	24	27 ± 7	7%	-	34%	12%	13%	28 ± 16
Di Biase <i>et al</i> ^[57]	92	27 ± 5	47%	100%	34%	0%	2%	25 ± 10
Izquierdo <i>et al</i> ^[71]	23	34 ± 10	0%	56%	-	35%	30%	Median 18
Jin <i>et al</i> ^[72]	40	21 ± 7	0%	80%	53%	-	25%	17 ± 17
Kumar <i>et al</i> ^[73]	287	27 ± 10 in ICM and 33 ± 16 in NICM	3.8% in ICM and 24% in NICM	60% in ICM and 50% in NICM	49% in ICM and 64% in NICM	17% in ICM and 27% in NICM	25% in ICM and 28% in NICM	Median 42
Muser <i>et al</i> ^[59]	267	29 ± 13	22%	73%	33%	5%	29%	Median 45

Effective in acute management and long-term electric storm recurrence

Acute Mechanical Circulatory Support Options for the LV

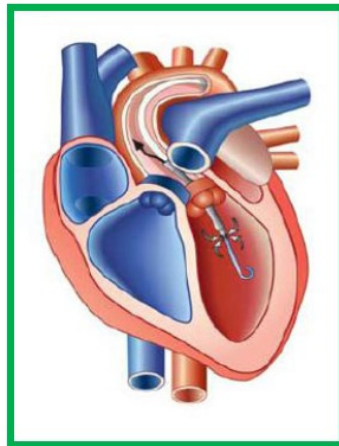
Continuous Flow Pumps

Pulsatile

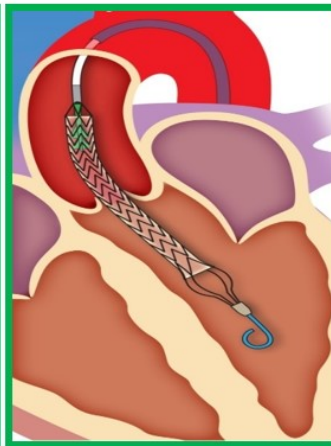


IABP

Axial-Flow

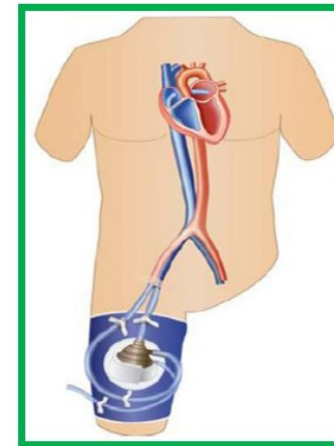


Impella CP

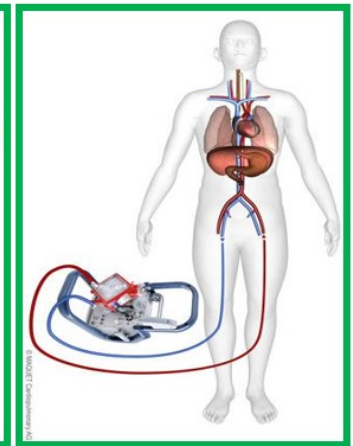


PHP *

Centrifugal Flow



TandemHeart



VA-ECMO

Intracorporeal

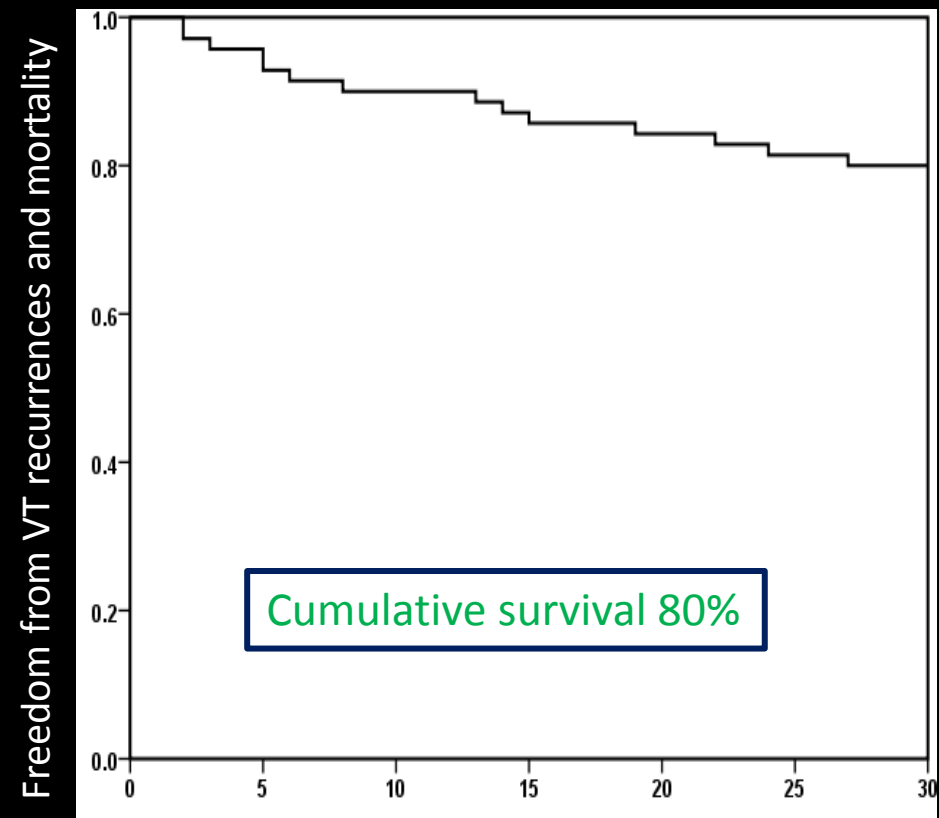
Extracorporeal

* Investigational

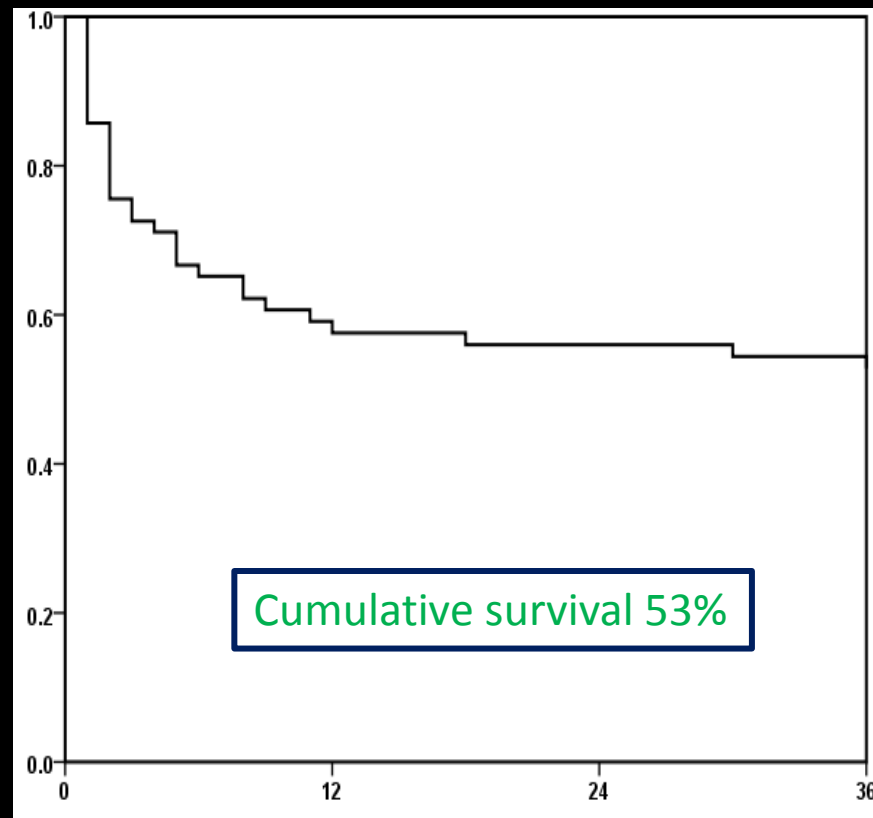
Taipei Experience: Rescue Ablation for Electric Storm Requiring Circulation Support

	ES with circulation support (group 1; N=26)	ES without circulation support (group 2; N=44)	P value
Male gender (%)	96%	84%	0.253
Age, mean \pm SD	67 \pm 15	46 \pm 17	<0.001
BMI, kg/m ²	27 \pm 12	25 \pm 4	0.254
Etiology:			<0.001
ICM (%)	65%	18%	
NICM (%)	35%	14%	
Comorbidity			
DM (%)	52%	9%	<0.001
CAD (%)	70%	32%	0.003
HTN (%)	78%	41%	0.004
renal failure, Cr >1.5 (%)	58%	9%	<0.001
Serum Cr, mg/dl	2.5 \pm 2.0	1.2 \pm 0.5	<0.001
Heart function			
NYHA Fc III / IV (%)	65%	39%	0.039
LVEF %	31 \pm 13	42 \pm 13	0.047
valvular dysfunction (%)	13%	9%	0.616

Taipei Experience: The Overall Outcome of Electric Storm Ablation



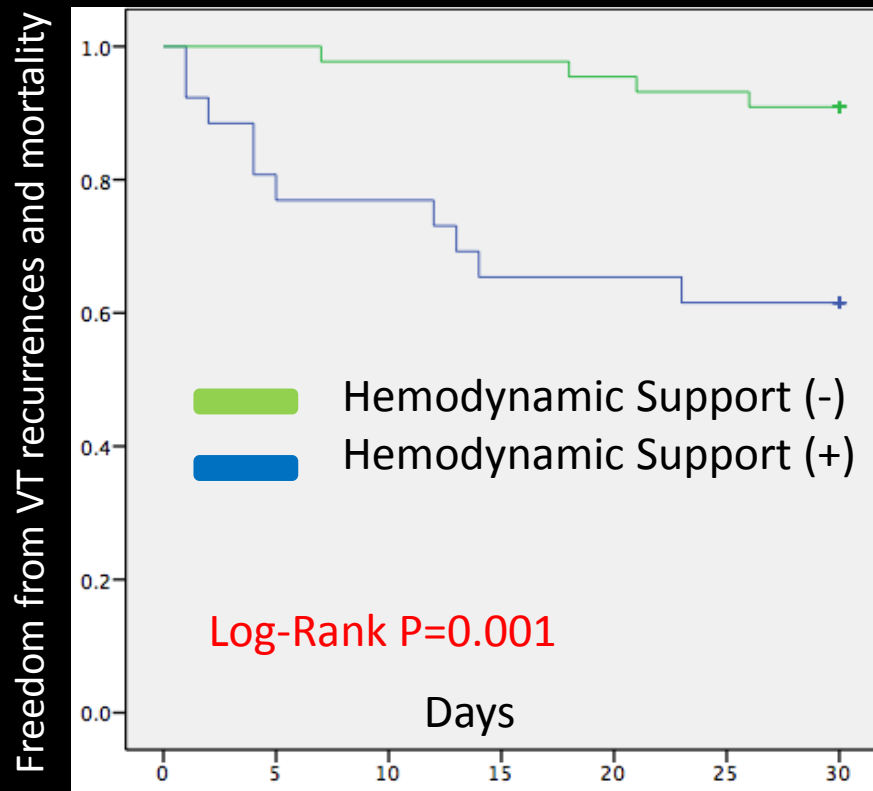
30-day Follow-up (Days)



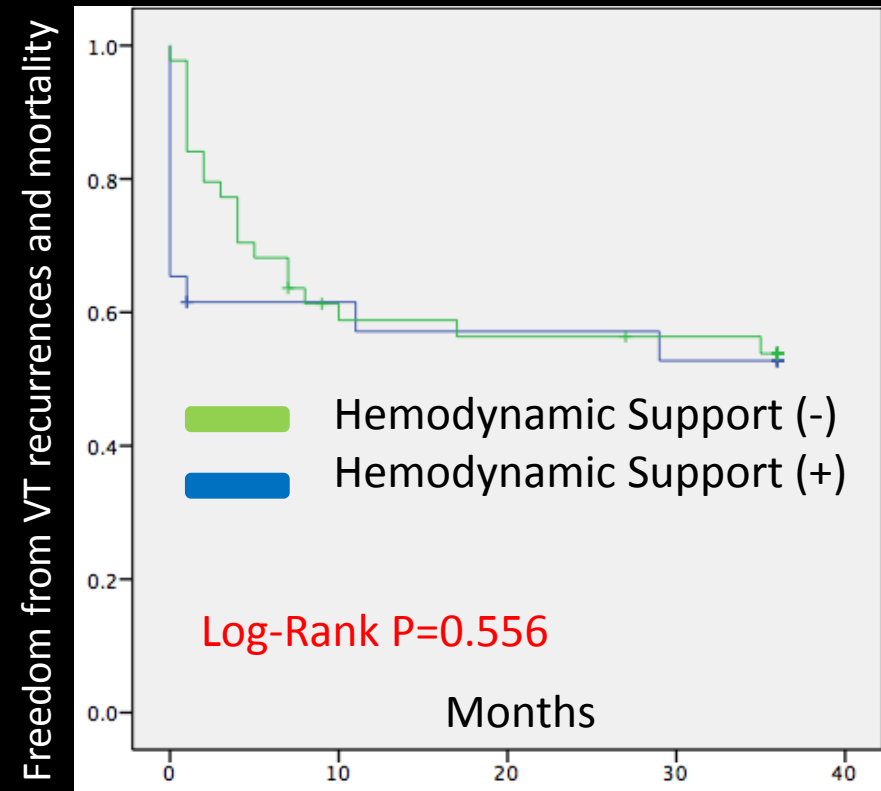
3-year Follow-up (months)

Taipei Experience of Electric Storm Ablation: Clinical Impact of Unstable VT/VF

Patients undergoing rescue ablation for unstable VT/VF requiring hemodynamic support had worse short-term outcome but similar mid-term (3 years) outcome



30-day Follow-up

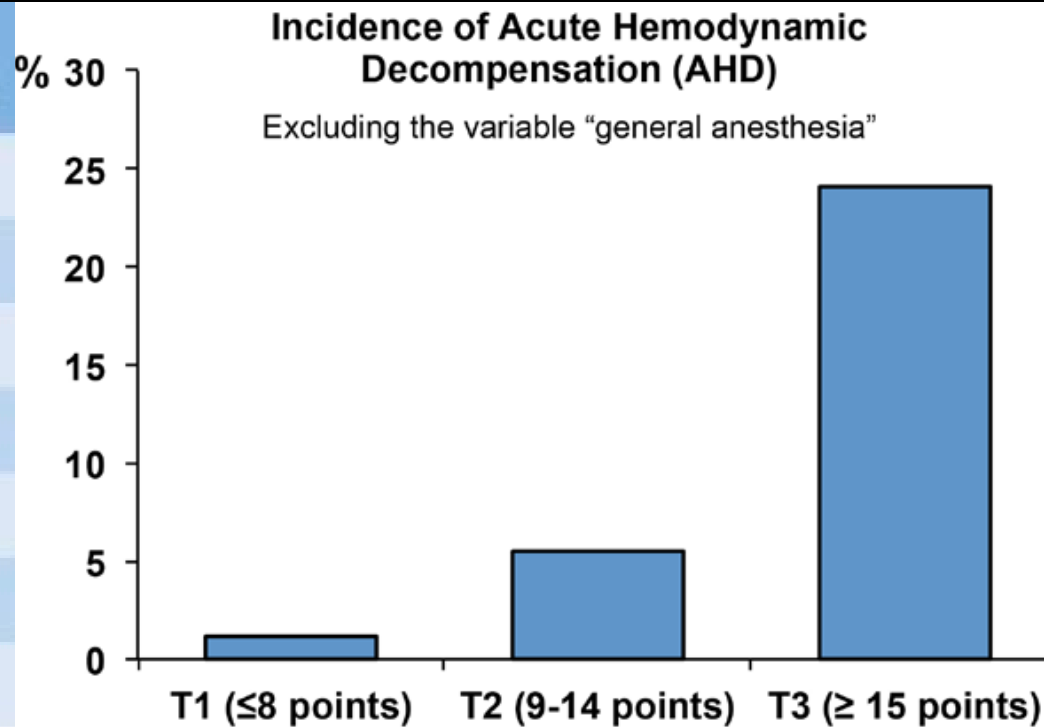


3-year Follow-up

Who Need Hemodynamic Support?

High risk: more incidence of acute heart decompensation during ablation

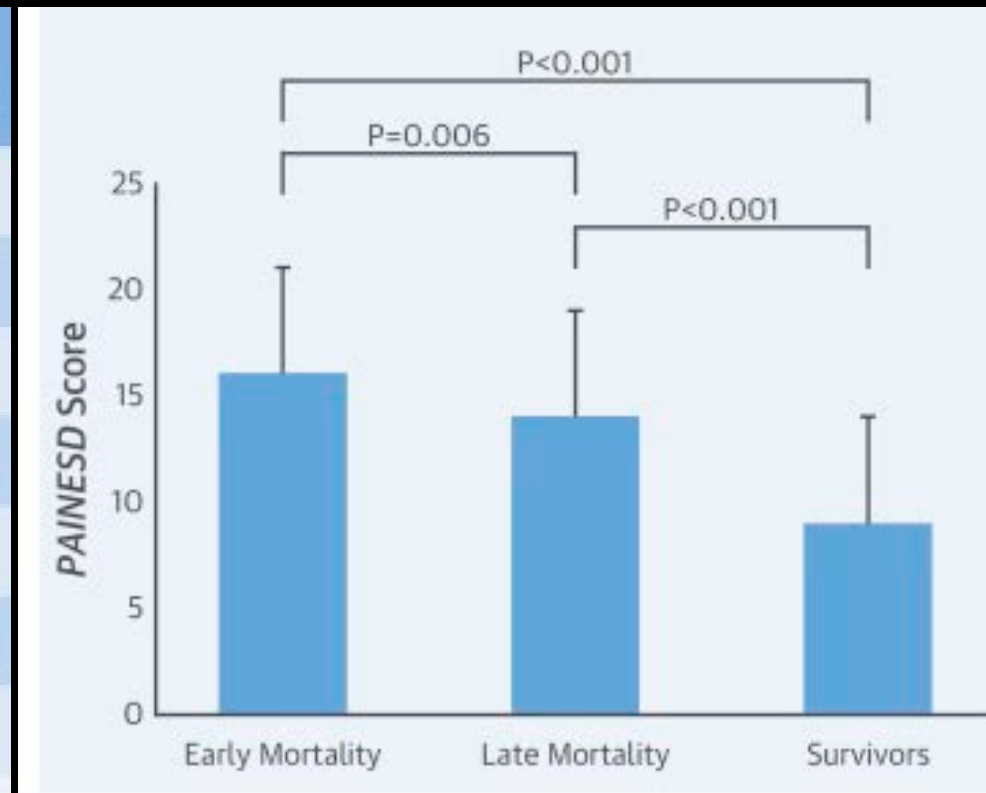
VARIABLE	<i>PAINESD</i> RISK SCORE	SCORE
Pulmonary disease [chronic obstructive]-COPD		5
Age >60 years		3
Ischemic cardiomyopathy		6
NYHA class III or IV		6
Ejection fraction <25%		3
Storm [VT]		5
Diabetes mellitus		3



Low medium High Risk

Predictors of Early Mortality

VARIABLE	<i>PAINESD</i> RISK SCORE	SCORE
Pulmonary disease [chronic obstructive]-COPD		5
Age >60 years		3
Ischemic cardiomyopathy		6
NYHA class III or IV		6
Ejection fraction <25%		3
Storm [VT]		5
Diabetes mellitus		3



Higher score was associated with early mortality

Take Home Message

- Reversible cause of electric storm should be identified
- **Optimal ICD programming** could decrease repetitive shock
- **Catheter ablation** is effective in controlling ischemic heart disease with low EF and electric storm .
- **Hemodynamic support** is important for acute LV failure and preventing heart decompensation in high risk patients