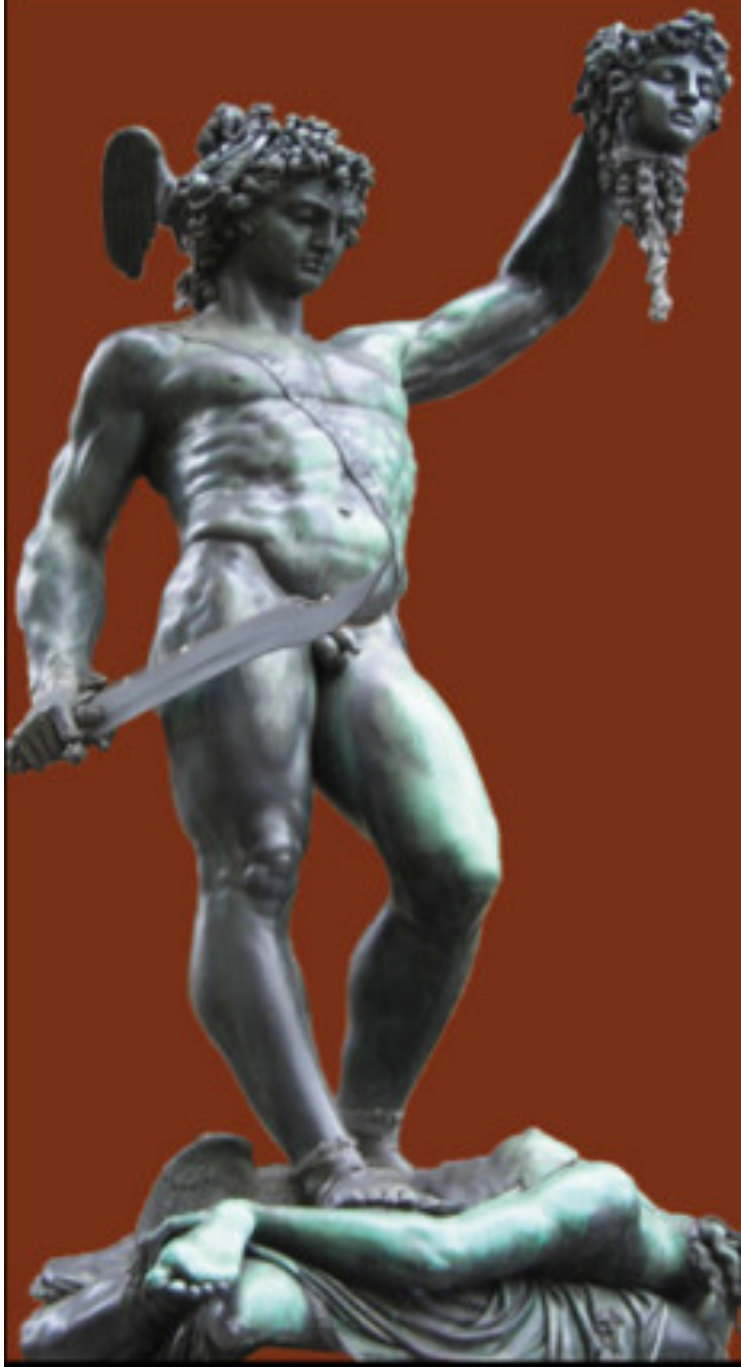


Conoscere e Curare il Cuore 2015

L'ABLAZIONE DELLA TACHICARDIA VENTRICOLARE NEL PAZIENTE CON CARDIOMIOPATIA (ISCHEMICA E NON). FACCIAMO IL PUNTO

Giovanni Luca Botto

Unità Operativa Elettrofisiologia e Cardiostimolazione
Ospedale Sant'Anna, Como

Class I Indications for ICD Therapy

AVID
CIDS

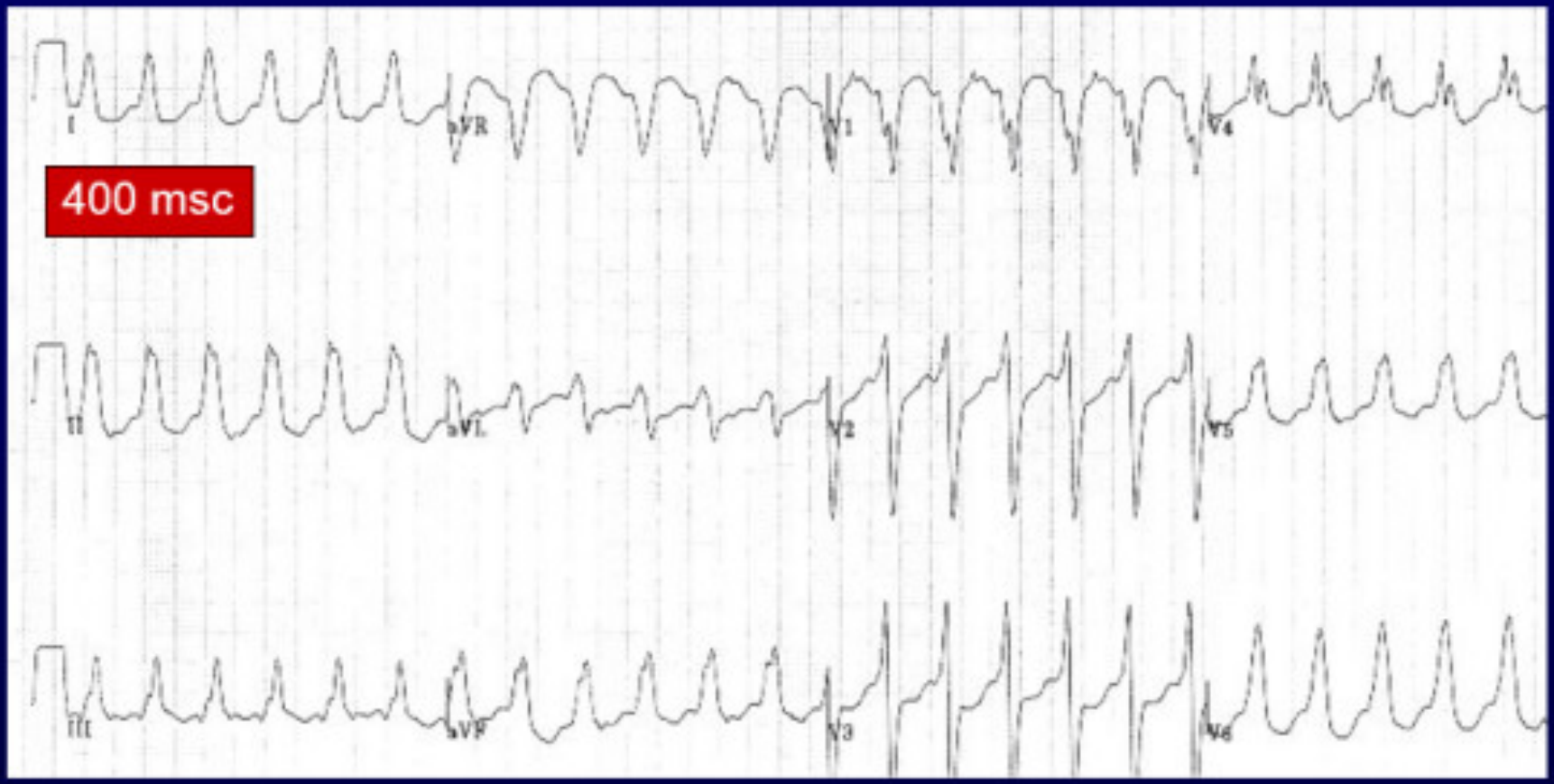
- ✓ Cardiac arrest due to VF or VT not due to a transient or reversible cause
  (Level of Evidence: A)
- ✓ Spontaneous sustained VT in association with structural heart disease *(Circ 2002)*
  (Level of Evidence: B)

CIDS
AVID
Registry
AVID
Substudy

- ✓ Syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at EP study when drug therapy is ineffective, not tolerated, or not preferred
  (Level of Evidence: B)

Gregoratos G. ACC/AHA/NASPE JACC 1998; 31: 1175-1209 & Circulation 2002; 106: 2145

Hybrid Rx in a Patients With Stable VT



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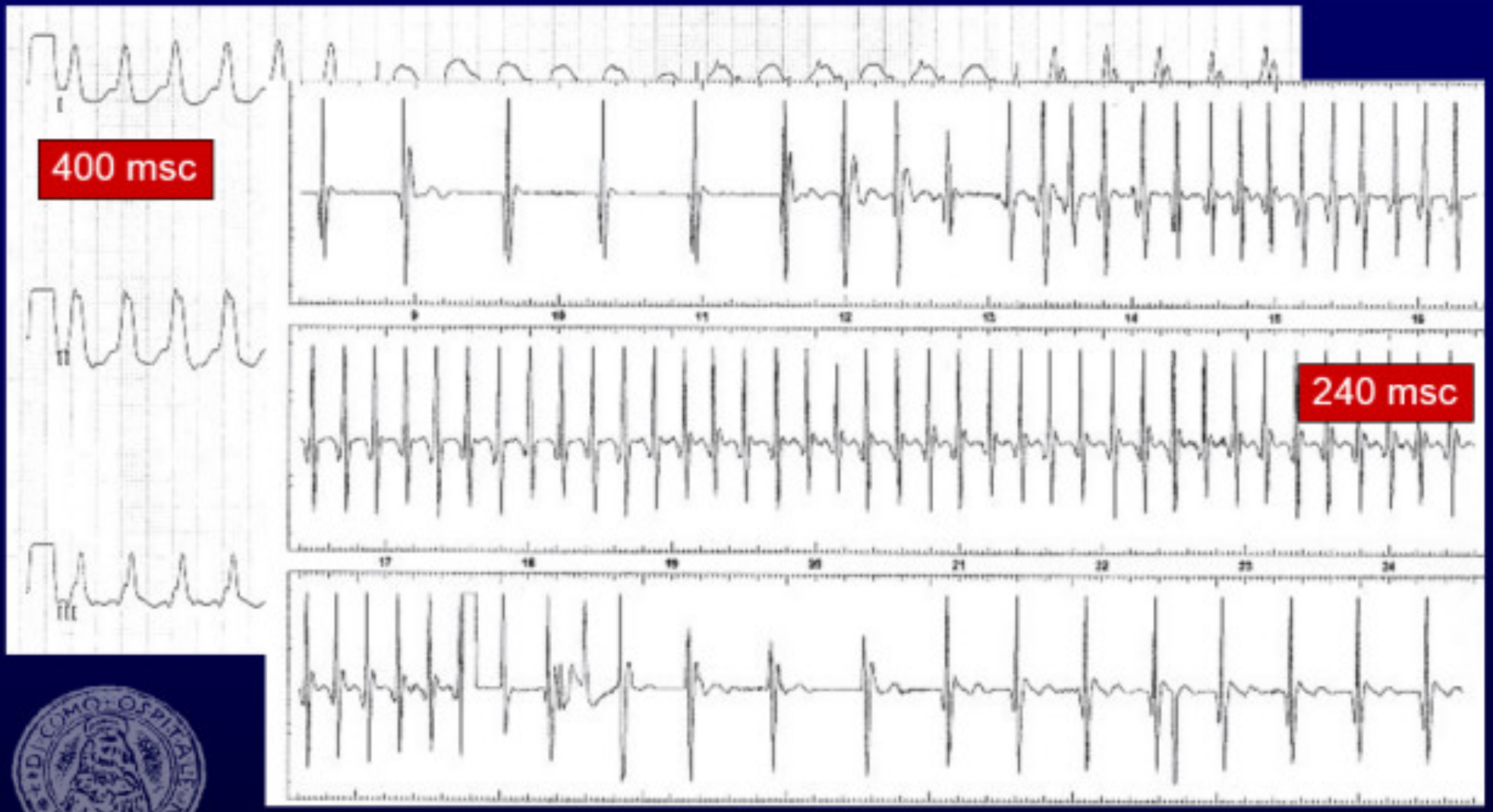
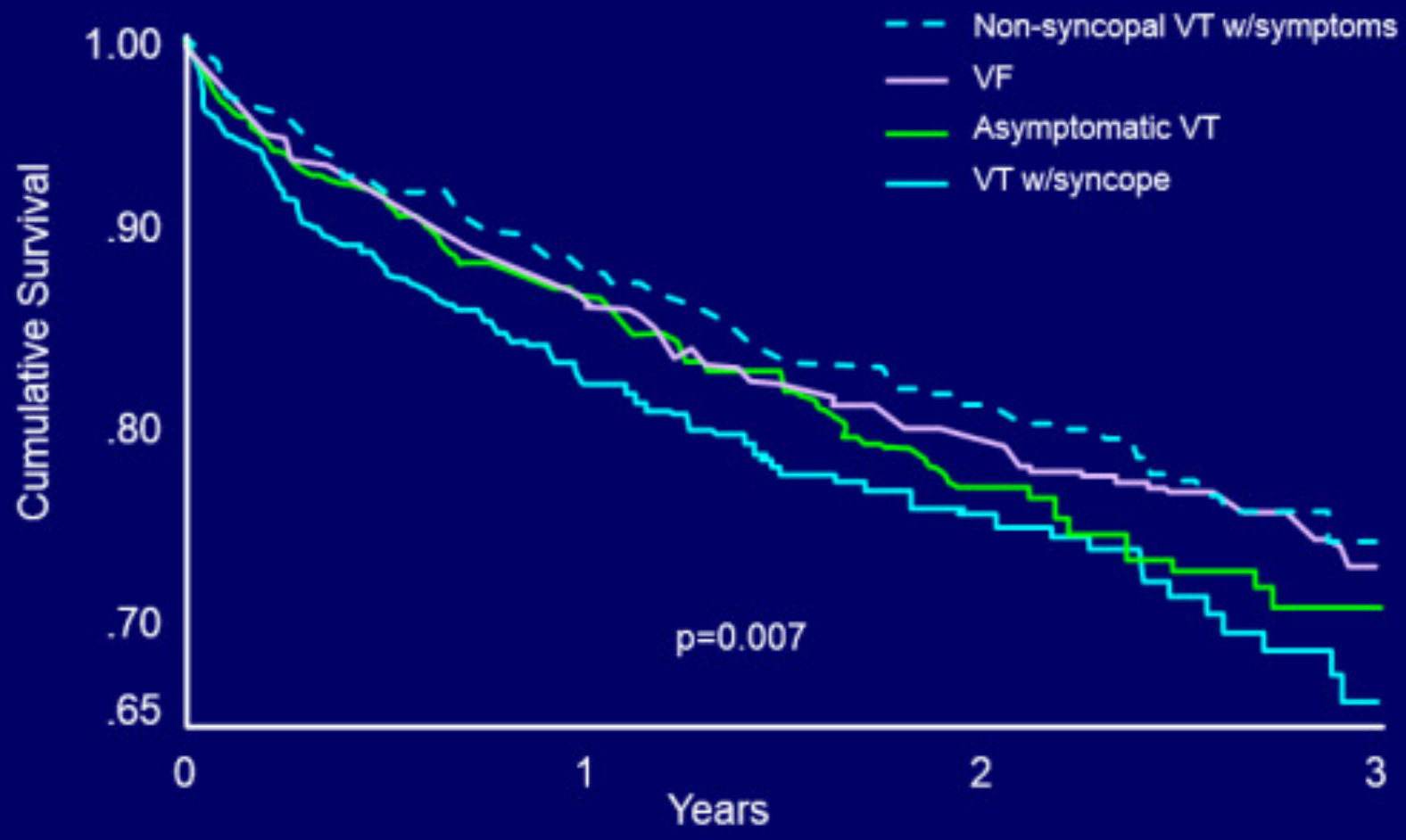


AVID Registry: *Survival by Arrhythmia Type*
Stable Vt is Not a Benign Rhythm



Anderson JL. Circulation 1999; 99: 1692-1699.

AVID Registry

Two-Year Survival Rates by Arrhythmia Type and EF

	n*	EF≥ 0.35, %	n*	EF< 0.35, %	n*	All, %
VF	656	85.7	680	73.6	1399	79.7
VT with syncope	241	81.5	339	73.0	598	75.7
Nonsyncopal VT with symptoms	419	84.7	624	78.6	1065	81.3
Asymptomatic VT	235	85.3	217	67.7	497	77.2

* Ejection fraction (EF) was missing for 4.4% of patients.

Arrhythmia presentation has no impact on survival, ICD is protective

Anderson JL. Circulation 1999; 99: 1692-1699.

AVID Registry

Clinical Characteristics by Presenting Arrhythmia

	VF	VT With Syncope	Symptomatic VT	Asymptomatic VT
No.	1399	598	1065	497
Age, yrs	62.8	65.8	64.6	63.3
EF	36.2	32.7	31.8	36.6
CAD, %	72.6	74.6	82.3	73.8
No cardiac disease, %	6.1	5.9	4.4	9.9
History, %				
MI	48.7	60.2	69.3	62.8
CHF	42.0	44.1	42.3	31.4
CABG /PTCA	29.6	30.3	36.9	34.8
Diabetes	21.4	24.0	19.3	18.5

Anderson JL. Circulation 1999; 99: 1692-1699.

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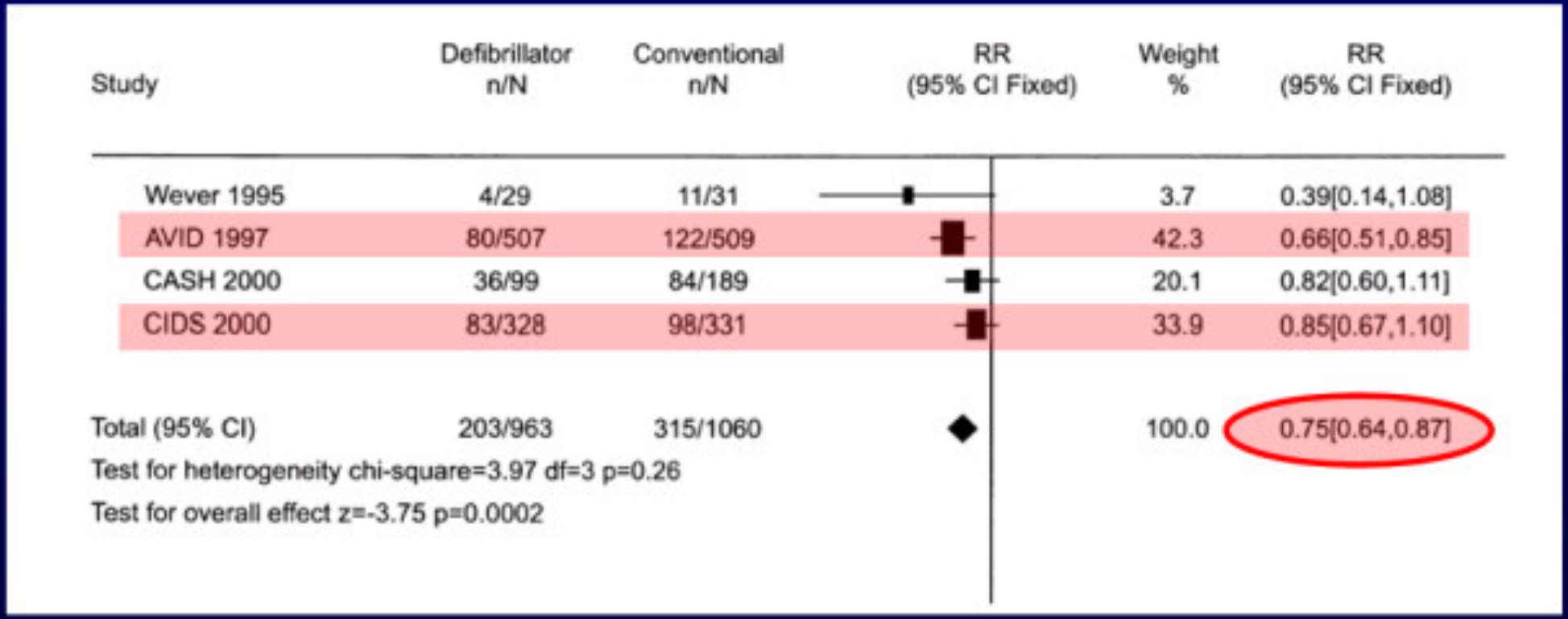
Anderson JL. Circulation 1999; 99: 1692-1699.

Effectiveness of ICDs in Preventing SD

A Meta Analysis



Absolute Reduction = 7%
Number Need to Treat = 15

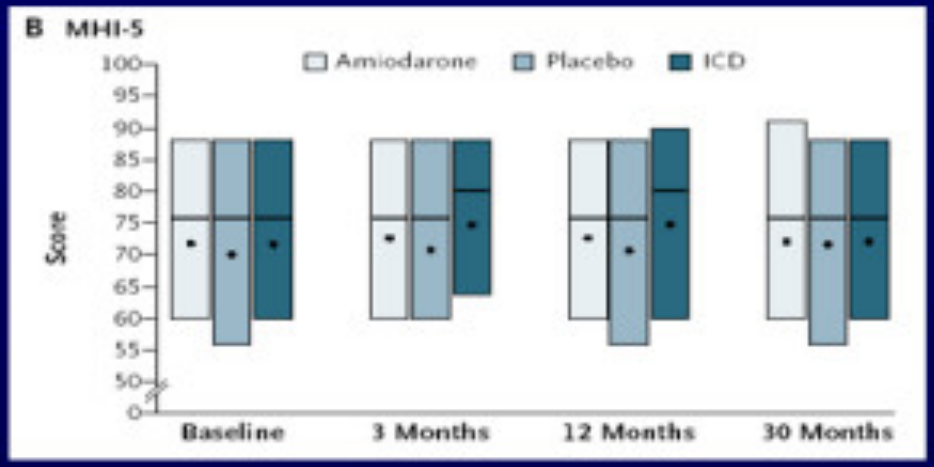
Lee DS: J Am Coll Cardiol 2003; 41: 1573

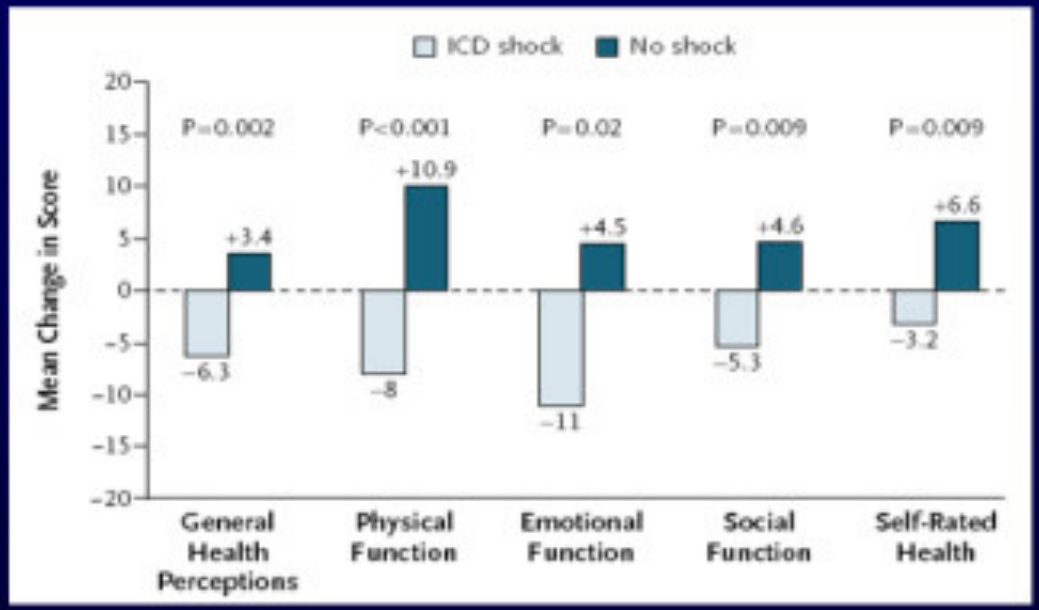
Quality of Life with Defibrillator Therapy or Amiodarone in Heart Failure

Daniel B. Mark, M.D., M.P.H., Kevin J. Anstrom, Ph.D., Jie L. Sun, M.S., Nancy E. Clapp-Channing, R.N., M.P.H., Anastasios A. Tsiatis, Ph.D., Linda Davidson-Ray, M.A., Kerry L. Lee, Ph.D., and Gust H. Bardy, M.D., for the Sudden Cardiac Death in Heart Failure Trial Investigators

Mark DB. NEJM 2008; 359: 999-1008

Psychological well-being in the ICD group, as compared with medical therapy alone, was significantly improved at 3 months (P = 0.01) and at 12 months (P = 0.003) but not at 30 months.





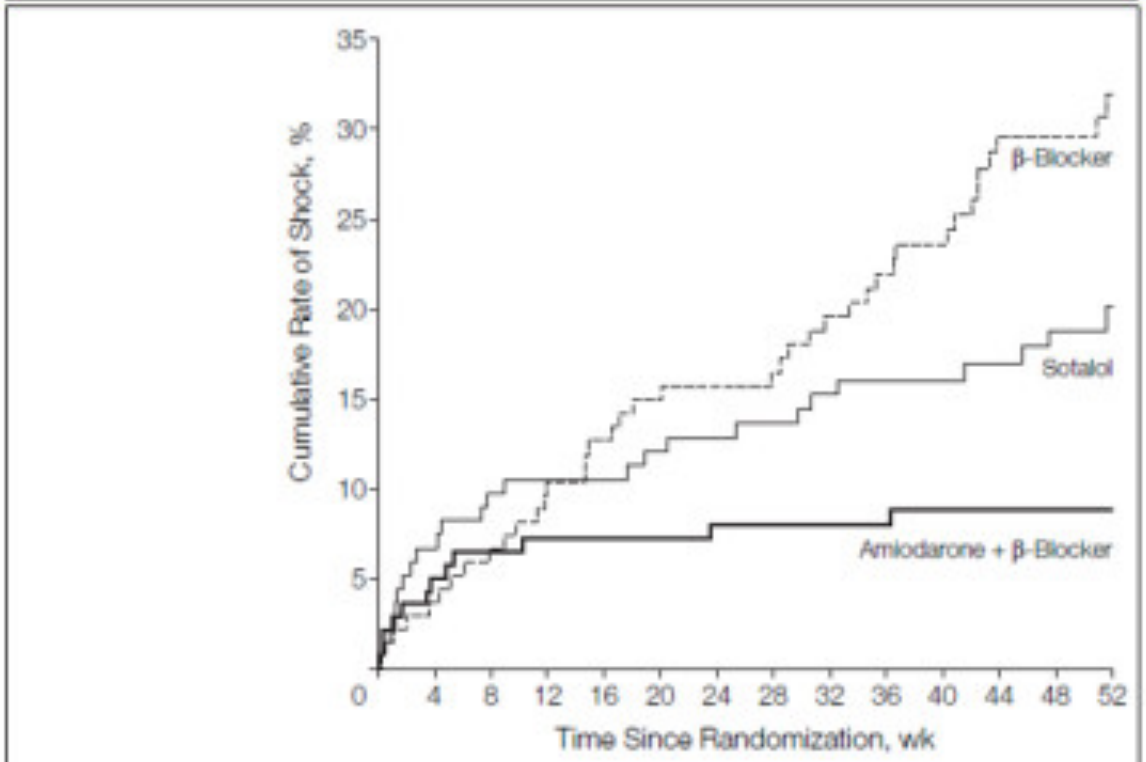
ICD shocks in the month preceding a scheduled assessment were associated with a decreased QoL in multiple domains

ICD therapy was not associated with any detectable adverse QoL effects during 30 months FU

Comparison of β-Blockers, Amiodarone Plus β-Blockers, or Sotalol for Prevention of Shocks From Implantable Cardioverter Defibrillators

The OPTIC Study: A Randomized Trial

Cumulative Rate of Shock for the 3 Treatment Groups



No. at Risk					
β-Blocker	138	119	109	91	42
Sotalol	134	118	108	94	35
Amiodarone + β-Blocker	140	124	115	106	56

Connolly SJ.
JAMA. 2006 ;295: 165-171

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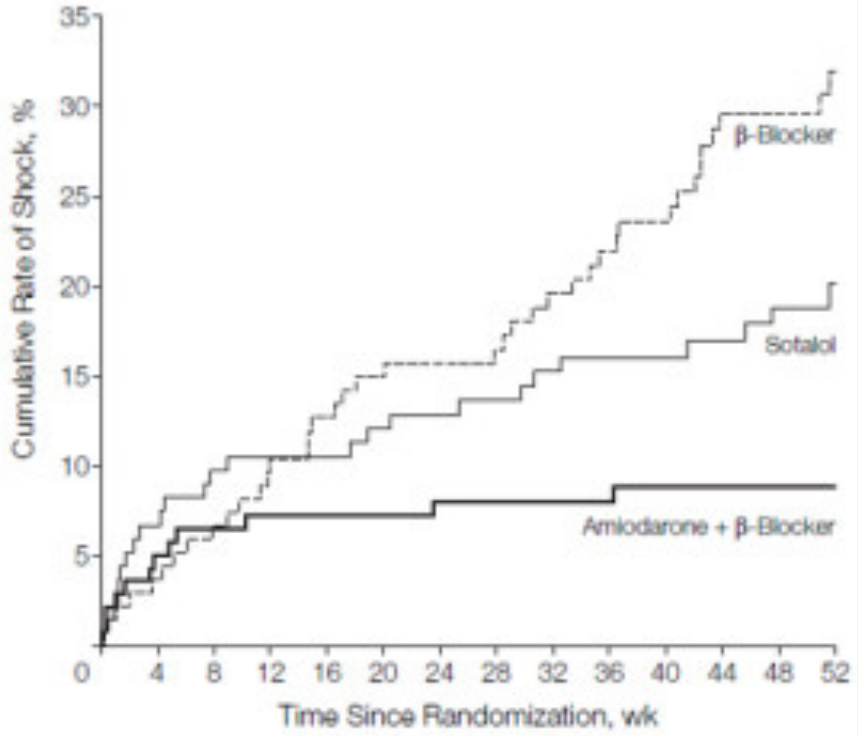
The OPTIC Study: A Randomized Trial

Adverse Events of the 3 Treatment Assignments

Adverse Event	No. of Patients (%) β-Blocker (n = 138)	Amiodarone + β-Blocker (n = 140)	Sotalol (n = 134)	*P* Value*
Death	2 (1.4)	6 (4.3)	4 (3.0)	.36
Arrhythmic death	1 (0.7)	2 (1.4)	1 (0.8)	.60
Myocardial infarction	1 (0.7)	1 (0.7)	0	.62
Heart failure	9 (6.5)	12 (8.6)	14 (13.4)	.14
Atrial fibrillation	6 (4.4)	1 (0.7)	6 (4.5)	.13
Pulmonary adverse event	0	7 (5.0)	4 (3.0)	.03
Hypothyroidism	0	6 (4.3)	1 (0.8)	.01
Hyperthyroidism	0	2 (1.4)	0	.14
Symptomatic bradycardia	1 (0.7)	8 (6.4)	2 (1.5)	.009
Torsades de pointes	0	0	0	>.99
Skin adverse event	2 (1.5)	4 (2.9)	3 (2.2)	.72
Device infection	1 (0.7)	2 (1.4)	4 (3.0)	.34
Hospitalized during follow-up	60 (43.3)	49 (34.9)	40 (30.1)	.32

Cumulative Rate of Shock for the 3 Treatment Groups



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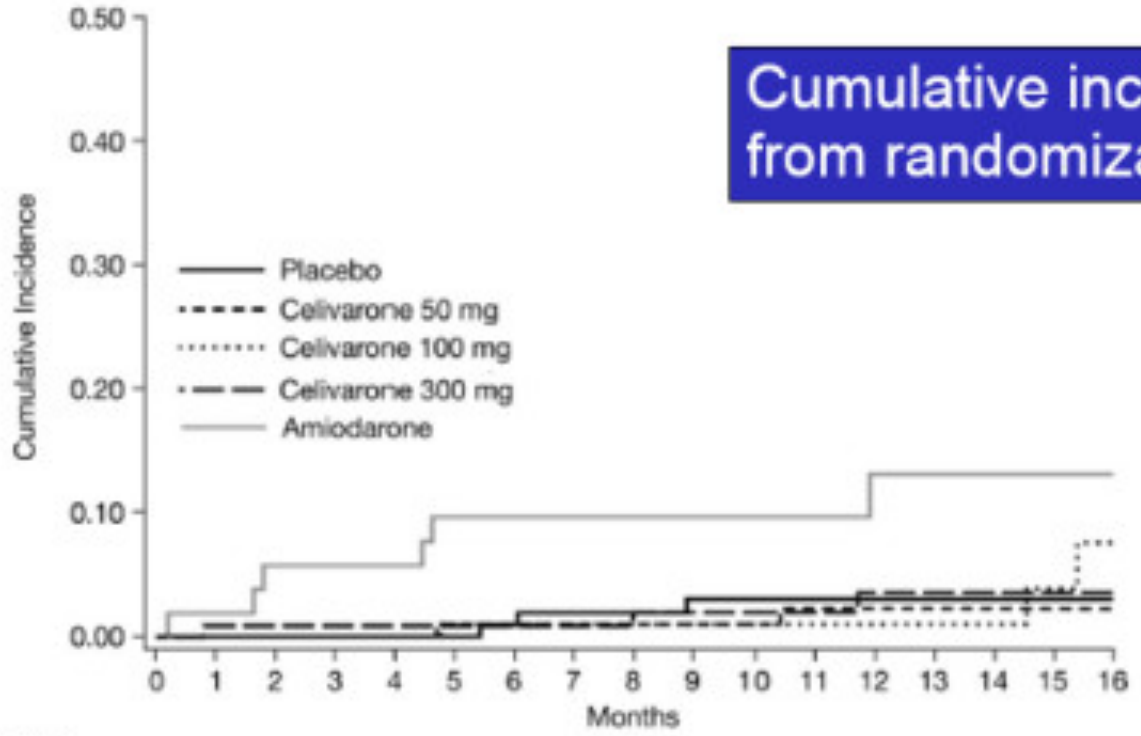
Efficacy and Safety of Celivarone, With Amiodarone as Calibrator, in Patients With an Implantable Cardioverter-Defibrillator for Prevention of Implantable Cardioverter-Defibrillator Interventions or Death

The ALPHEE Study



Cumulative incidence from randomization to SD

Number at Risk						
Placebo	109	107	105	83	60	26
Celivarone 50 mg	109	107	106	80	56	30
Celivarone 100 mg	102	101	100	83	54	32
Celivarone 300 mg	113	111	106	87	60	24
Amiodarone	53	49	46	38	25	16

PR. Kowey
Circulation. 2011
124:2649-2660

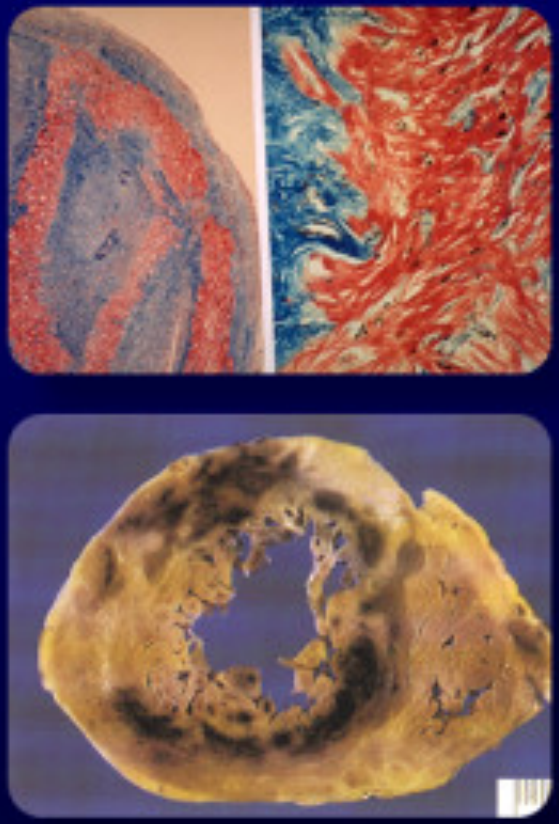
Sustained Monomorphic VT

EHRA/HRS/APHRS Expert Consensus on VA 2014

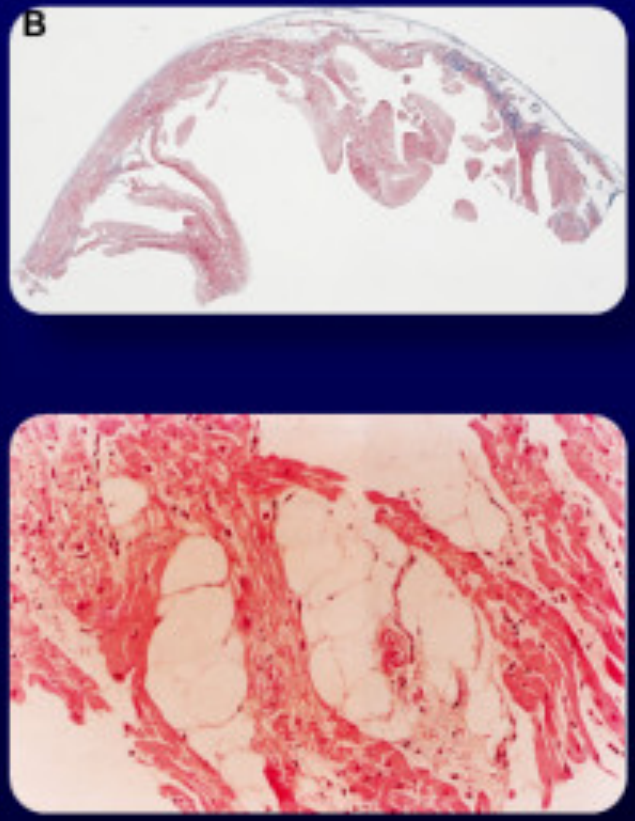
- A 12-lead ECG should be recorded during sustained VTs whenever possible and practical. (I) LOE B
- For pts with SHD and SMVT, an ICD is recommended in the absence of contraindications. (I) LOE A
- For patients with SHD and recurrent SMVT, specific treatment of VAs with
  - AADs (amiodarone, mexiletine, or sotalol), and/or
  - Catheter Ablation, and/or
  - ATP from ICD should be considered. (IIa) LOE B
- *Treatment of the underlying SHD or ischaemia will in most cases not be sufficient to prevent MMVT recurrences.*

VT in Structural Heart Diseases

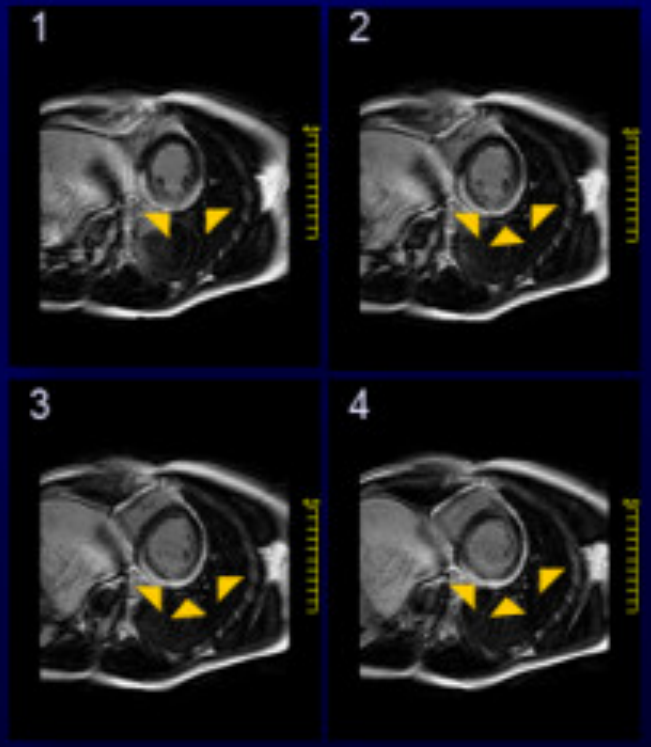
Post-MI CMP



ARVD



Post-Myocarditis



Catheter Ablation of VT

Prospective Studies in Patients With Ischemic CMP

Studies	Patients, n	EF (%)	Substrate	Treatment	Type of VT	Mapping	Acute success, n (%)	FU (ms)	Long-term success	Long-term mortality
Prospective randomized multicentre trials										
Kuck et al. 2010[9]	107		ICM	VT ablation + ICD vs. ICD only	Only stable VT	Mapping during VT/ substrate mapping		22.5 (9)		
Active	52	34 ± 10					27 (60%)		47%	10%[a]
Control	55	34 ± 9							29%	7%[a]
Reddy et al. 2007[10]	128		ICM	VT ablation + ICD vs. ICD only	All VT	Substrate mapping		22.5 (5.5)		
Active	64	31 ± 10					NA[b]		88%	9%
Control	64	33 ± 9							67%	17%
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Non-randomized prospective multicentre trials										
Tanner 2009	63	30 ± 13	ICM	VT ablation	All VT	Mapping during VT/ substrate mapping	51 (81%)	12 (3)	51%	9%[c]
Stevenson et al. 2008[11]	231	25[d]	ICM	VT ablation	All VT	Mapping during VT/ substrate mapping	113 (49%)	6[e]	53%	18%[f]
Calkins et al. 2000[7]	146	31 ± 13	ICM/NICM	VT ablation	All VT	Mapping during VT/ substrate mapping	59 (41%)	8 ± 5	46%	25%[g]
Non-randomized prospective single-centre trials[i]										
Niwano 2008	58	37 ± 7	ICM/NICM	VT ablation	All VT	Mapping during VT/ substrate mapping	43 (74%)	31 ± 22	75%	16%
Carbucicchio et al. 2008[8]	95	36 ± 11	ICM/NICM/ ARVC	VT ablation	Electrical storm	Mapping during VT/ substrate mapping	85 (89%)[h]	22 ± 13	63 (66%)	16%

Wissner E, Stevenson WG, Kuch KH. Eur Heart J 2012

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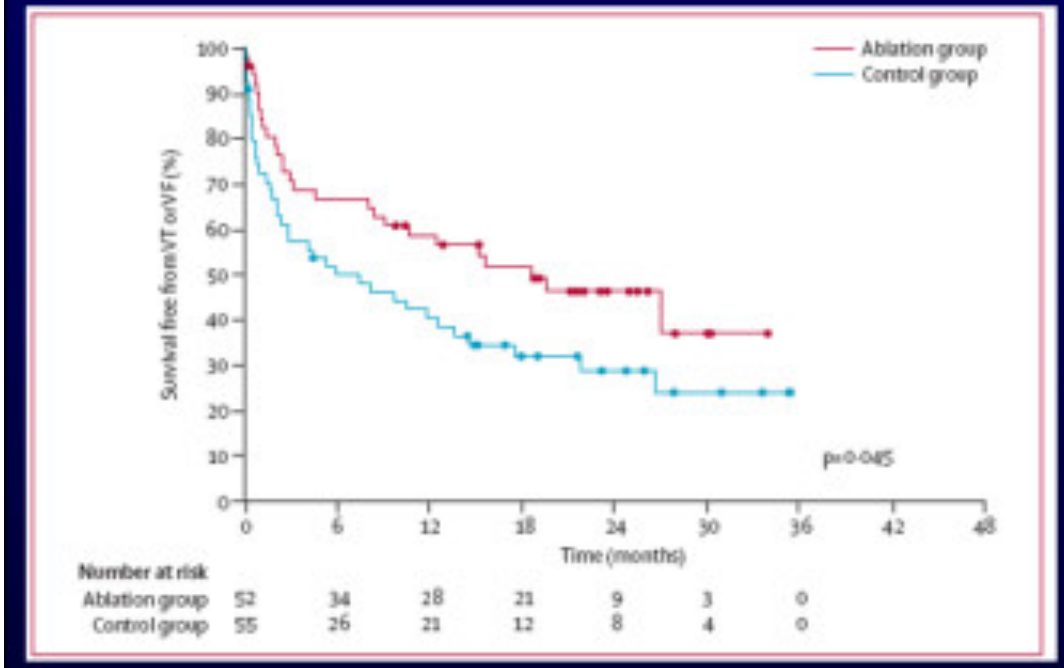
Wissner E, Stevenson WG, Kuch KH. Eur Heart J 2012

Prophylactic Catheter Ablation to Prevent ICD Rx

Only Stable VTs Included



Kuck KH. Lancet 2010; 375: 31-40

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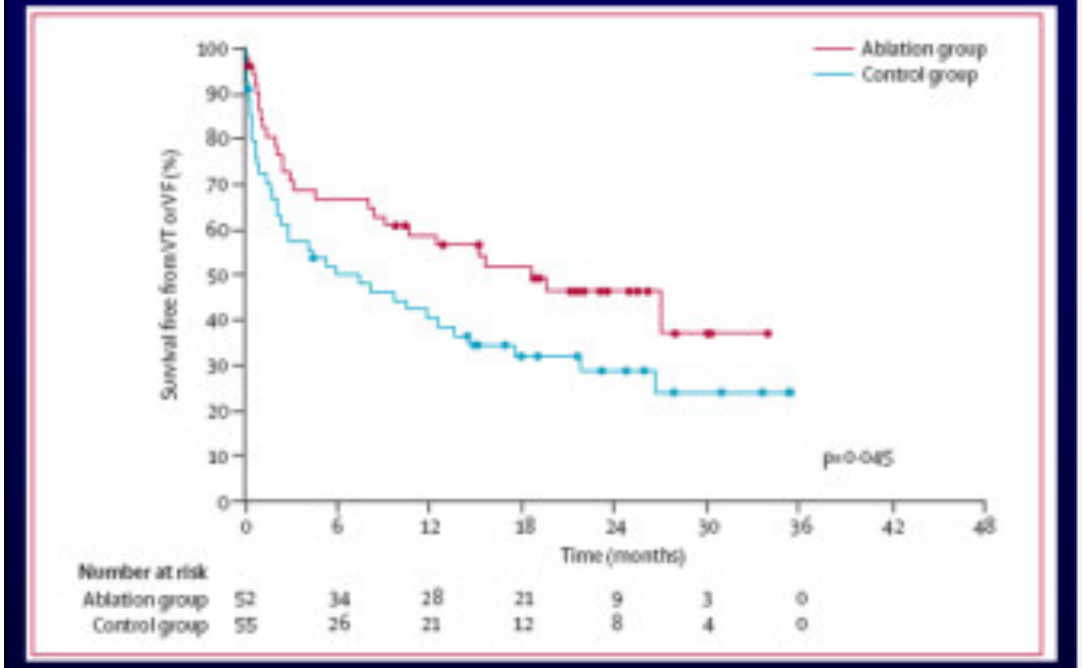

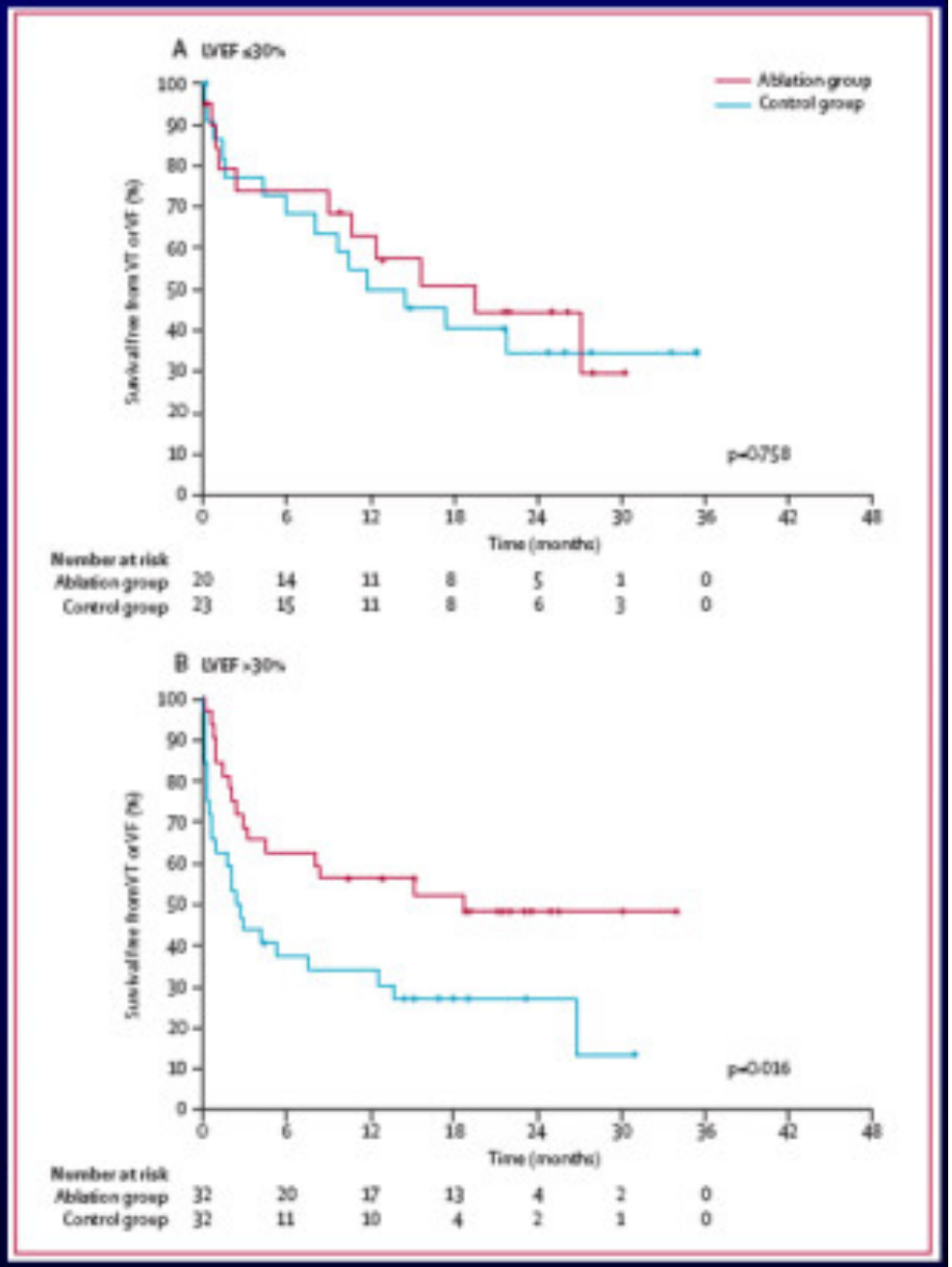

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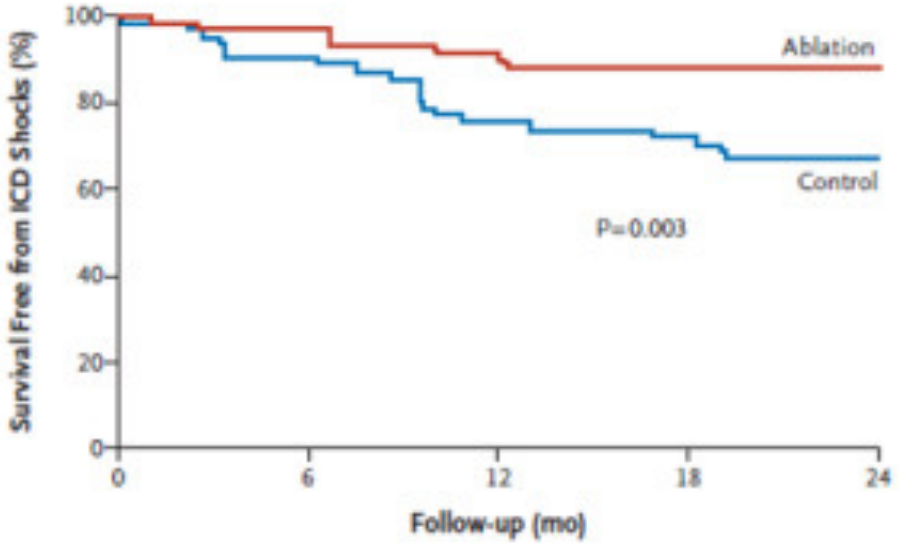
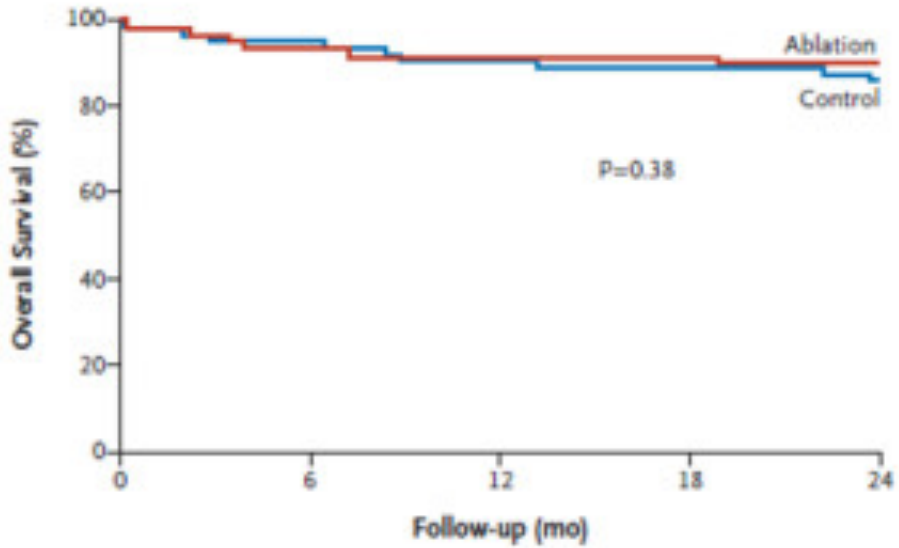
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 27, 2007 VOL. 357 NO. 26

Prophylactic Catheter Ablation for the Prevention of Defibrillator Therapy

Stable and Unstable VTs





Reddy VY. N Engl J Med 2007; 357: 2657-65

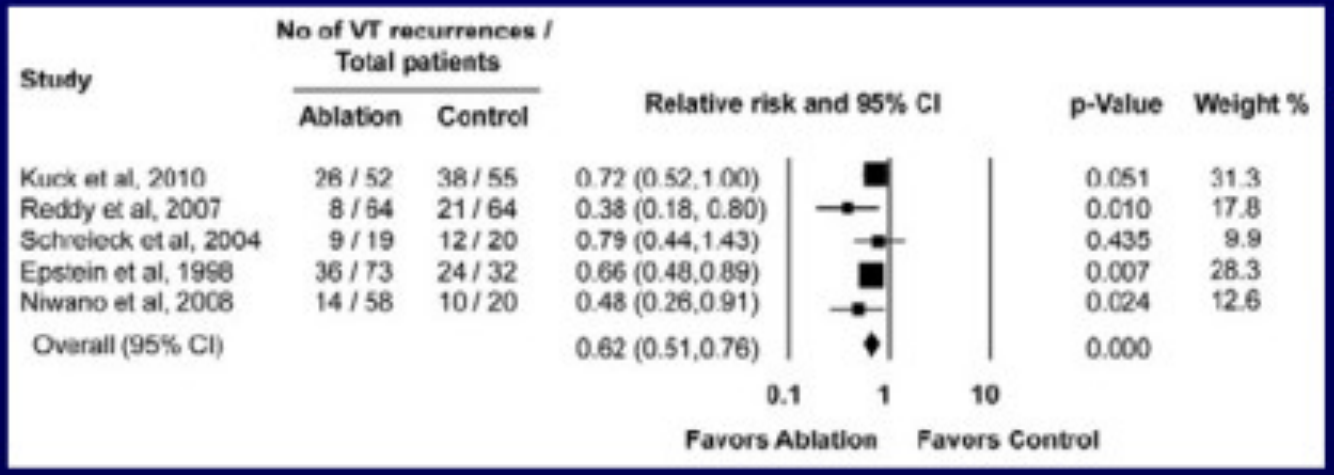
Catheter Ablation of VT

Prospective Studies in Patients With Non-Ischemic CMP

Study	Patients, *n*	Substrate	EF (%)	Endocardial mapping (%)	Epicardial access (%)	Acute complications (%)	Acute success (%)	Long-term complications (%)	Long-term success, *n* (%)	FU (ms)	Mortality during FU (%)
Multicentre experience											
Dukkipati *et al.* 2011[54]	10	HCM	57 ± 13	10/10 (100%)	10/10 (100%)	None	8/9 (89%)[a]	1/10 (10%)	7/9 (70%)[a,b]	37.4 ± 16.9	Not reported
Sacher 2008[46]	149	NICM	39 ± 16	149/149 (100%)	Not reported	12/195 (6.2%)[c]	99/195 (51%)[c]	Not reported	61% after a median FU of 1 month	40 ± 29	26/149 (17%)
Single-centre experience											
Koplan *et al.* 2006[53]	8	Sarcoid	34 ± 15	8/8 RV, 6/8 LV	2/8 (25%)	Not reported	2/8 (25%)	Not reported	6/8 (75%) within first 6 ms	(6 ms to 7 yrs)	1/8 (13%)
Soejima *et al.* 2004[25]	28	DCM	30 ± 11	20/28 (71%)	7/28 (25%)	2/28 (4%),1 epi, 1 endo	17/28 (61%)	Not reported	17/28 (61%)	11.1 ± 9.3	1/28 (4%)
Hsia *et al.* 2003[52]	19	NICM	34 ± 11	19/19 (100%)	None	Not reported	14/19 (74%)	Not reported	5/19 (26%)[d]	22 ± 12	4/19 (21%)

Wissner E, Stevenson WG, Kuch KH. Eur Heart J 2012

Meta-Analysis of Catheter Ablation For VT in Patients With Structural HD

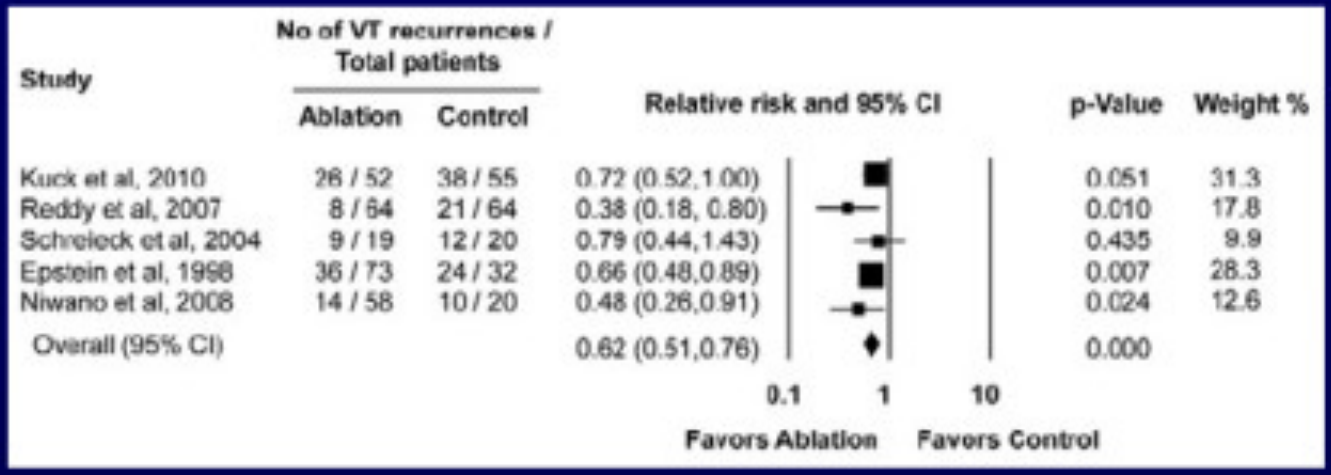


VT recurrence

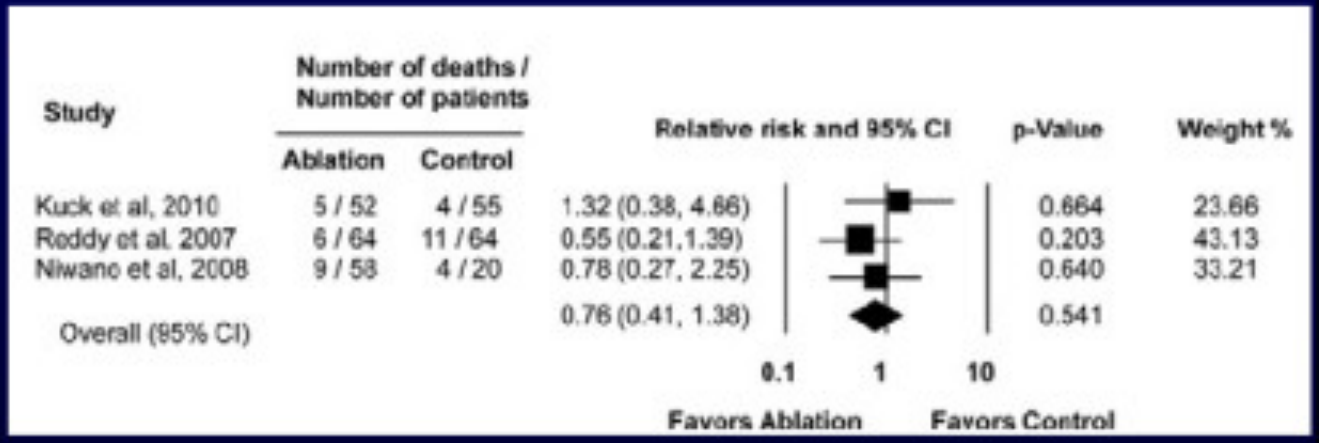
Mallidi J. Heart Rhtym 2011; 8: 503-510

Meta-Analysis of Catheter Ablation For VT in Patients With Structural HD

VT recurrence



Mortality

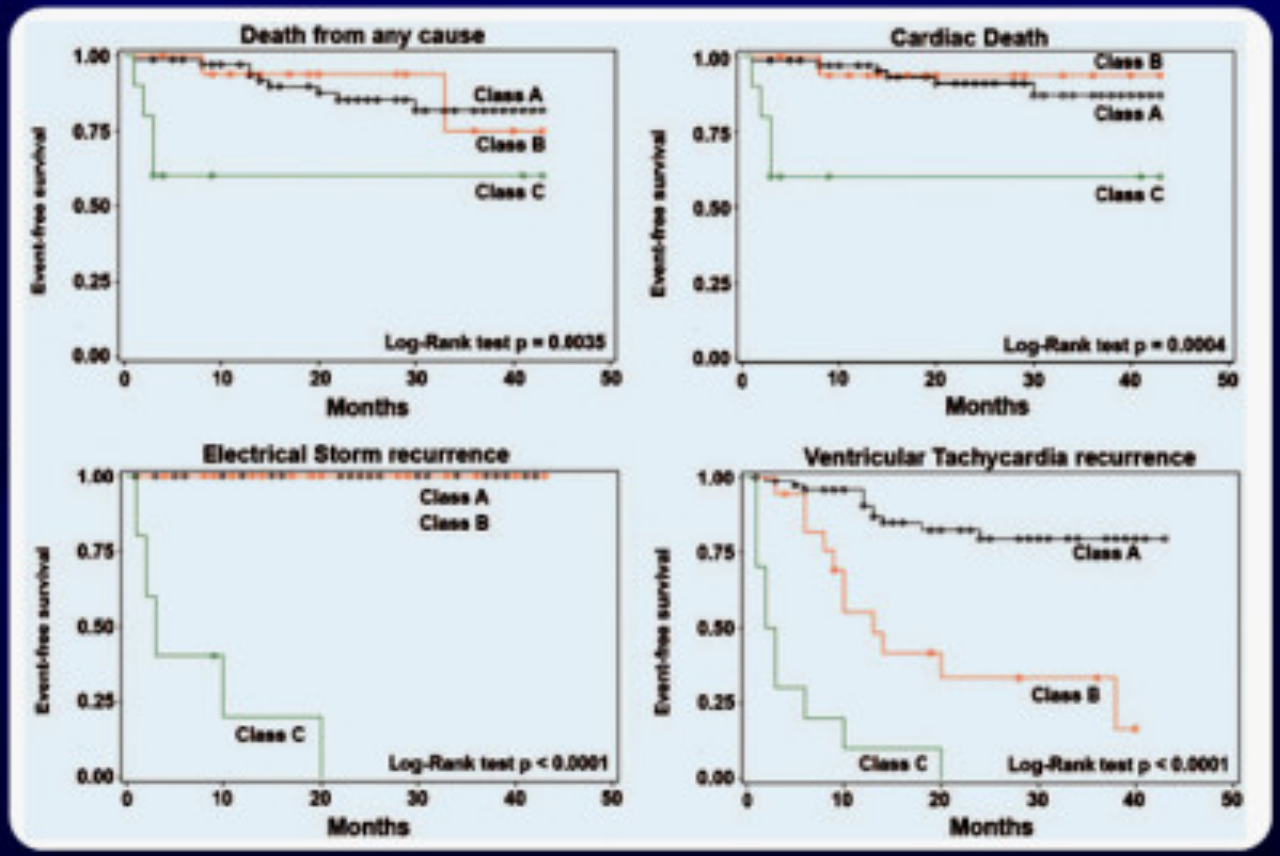


Mallidi J. Heart Rhtym 2011; 8: 503-510

Event-Free Survival According To Acute CA Results in Pts with Electrical Storm

Age (mean±SD), y	64±13
Gender, M/F	85/10
LV ejection fraction (mean±SD), %	36±11
NYHA class (mean±SD)	2.9±1.1
Underlying heart disease, %	
CAD	72 (76)
IDCM	10 (11)
ARVD	13 (14)
Medications, %	
Amiodarone	89 (94)
β-Blockers	92 (97)
ACE inhibitors or ARBs	81 (85)
Sotalol	5 (5)
Class I antiarrhythmic drugs	6 (6)
VT episodes per patient per day (mean±SD), n	16±8
ICD shocks per patient per day (mean±SD), n	14±8
Time from implant to ES (mean±SD), mo	14±8
Spontaneous VT cycle (mean±SD), ms	381±62
Spontaneous VT pleomorphism, %	36 (38)

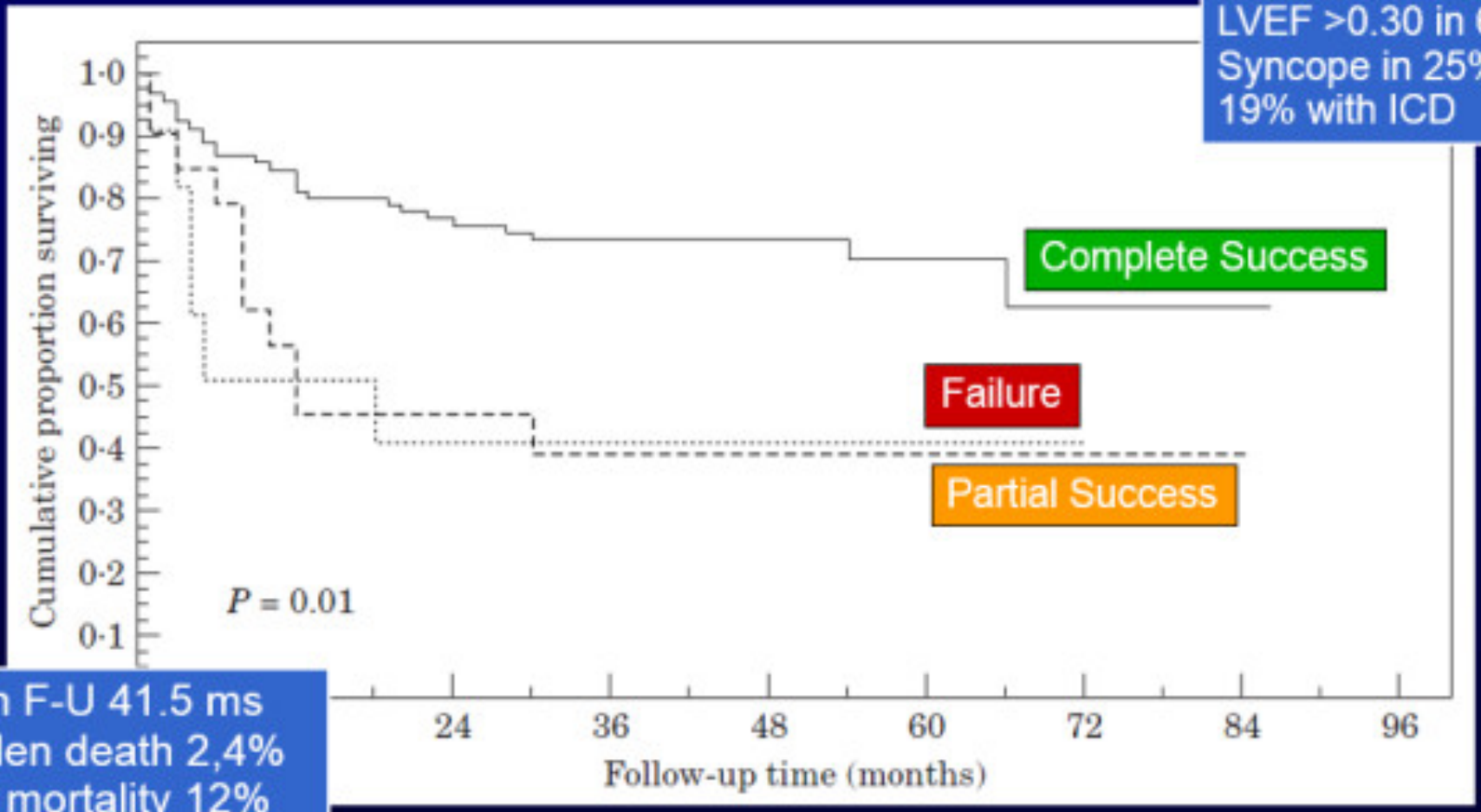
Success	Complete	Partial	Unsuccess
#pz (%)	68 (72%)	17 (18%)	10 (11%)



Carbucicchio C. Circulation. 2008; 117: 462-469

Catheter Ablation For Hemodynamically Tolerated Post-Infarction VT

124 pts
64±8 ys
86% on Amio and BB
LVEF >0.30 in 68%
Syncope in 25%
19% with ICD

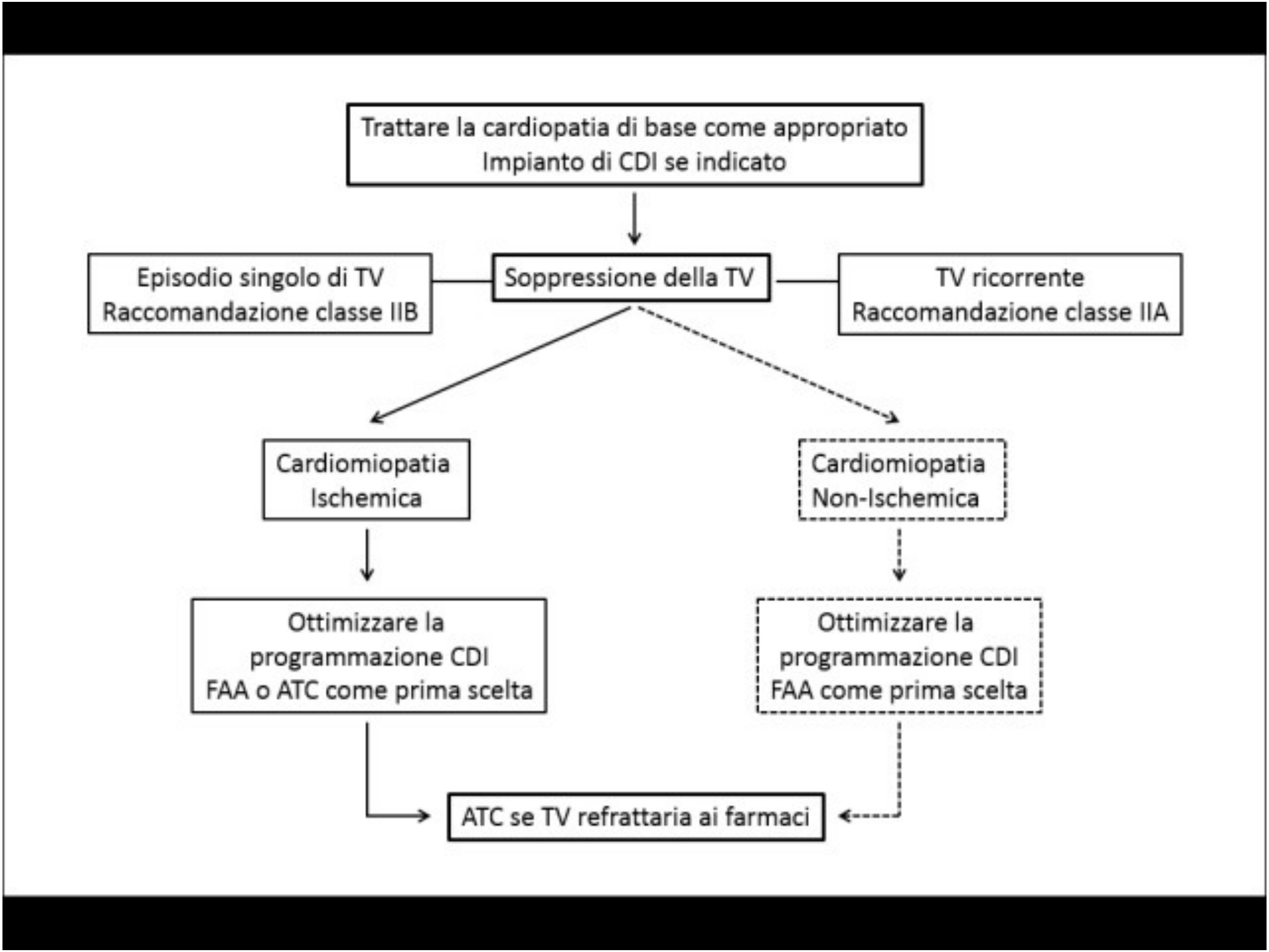


Mean F-U 41.5 ms
Sudden death 2,4%
Total mortality 12%

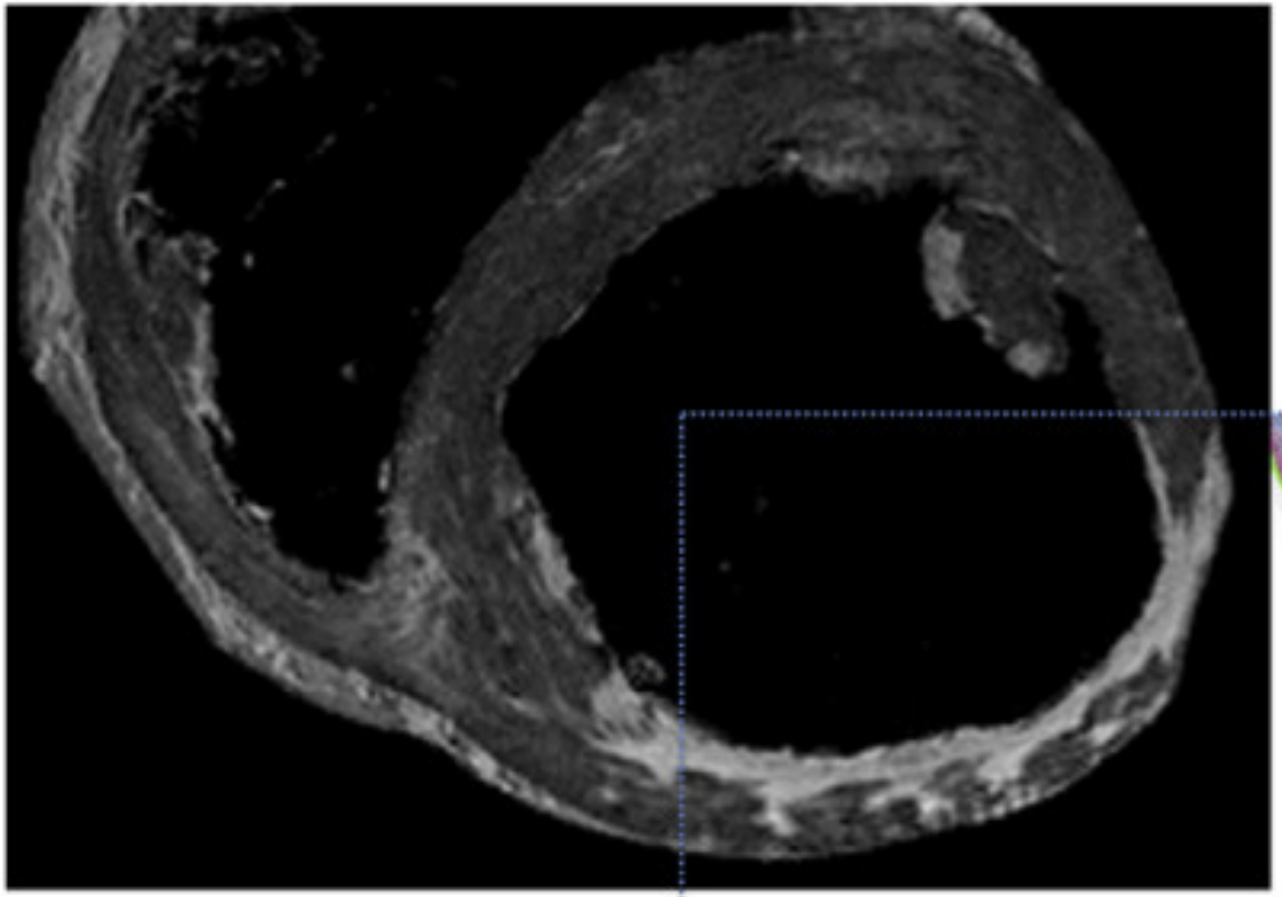
Della Bella P, De Ponti R, et al. Eur Heart J 2001; 23: 414-424

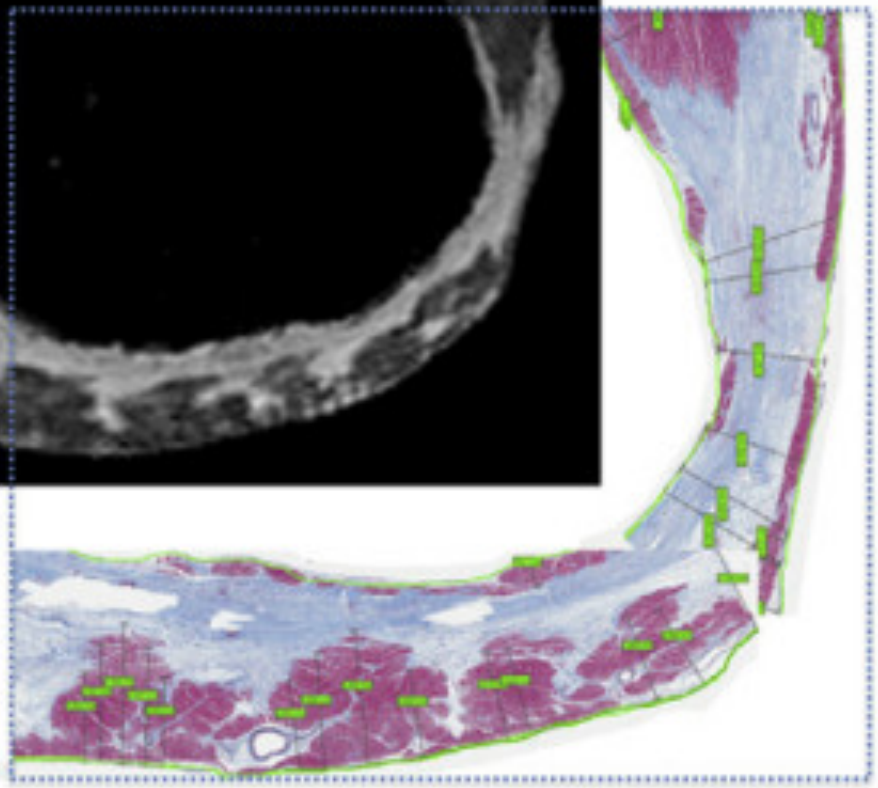
Meta-Analysis of Catheter Ablation For VT in Patients With Structural HD

Study	Epstein 1998	Reddy 2007	Kuck 2010	Total
N°	73	64	52	189
Rate	9,6%	4,7%	11,5%	8,4%
Type	2 deaths 1 stroke 1 perforation 3 AVB III	1 perforation 1 HF exacerbation 1 DVT	1 ST elevation 1 TIA 2 lead dislodgement 2 generator defect	death 1% stroke/TIA 1% perforation 1% AVB III 1,6% ICD related 2,1%

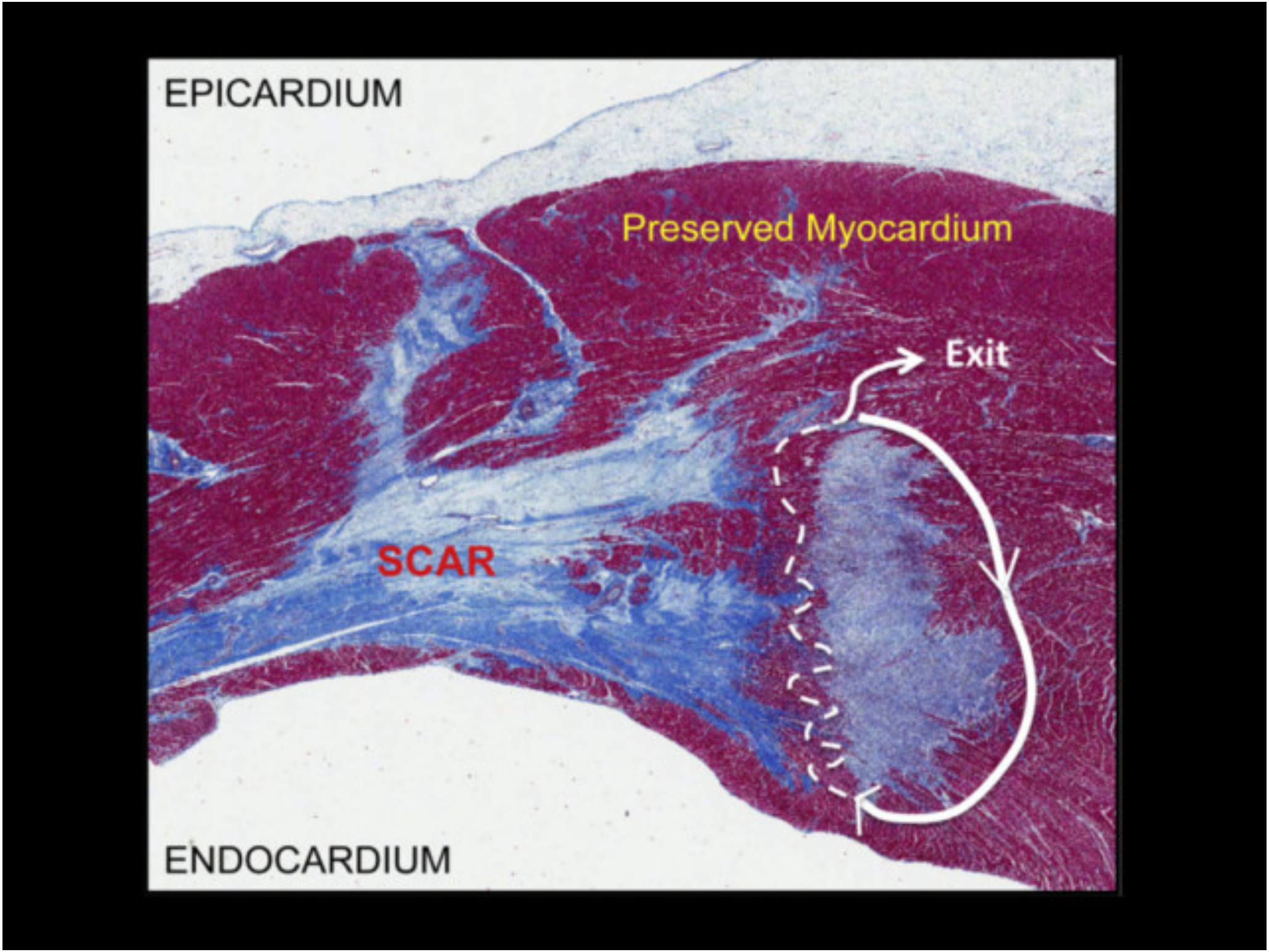

Trattare la cardiopatia di base come appropriato
Impianto di CDI se indicato
Episodio singolo di TV
Raccomandazione classe IIB
Soppressione della TV
TV ricorrente
Raccomandazione classe IIA
Cardiomiopatia
Ischemica
Cardiomiopatia
Non-Ischemica
Ottimizzare la
programmazione CDI
FAA o ATC come prima scelta
Ottimizzare la
programmazione CDI
FAA come prima scelta
ATC se TV refrattaria ai farmaci

Ex Vivo MRI Of An Infarcted Porcine

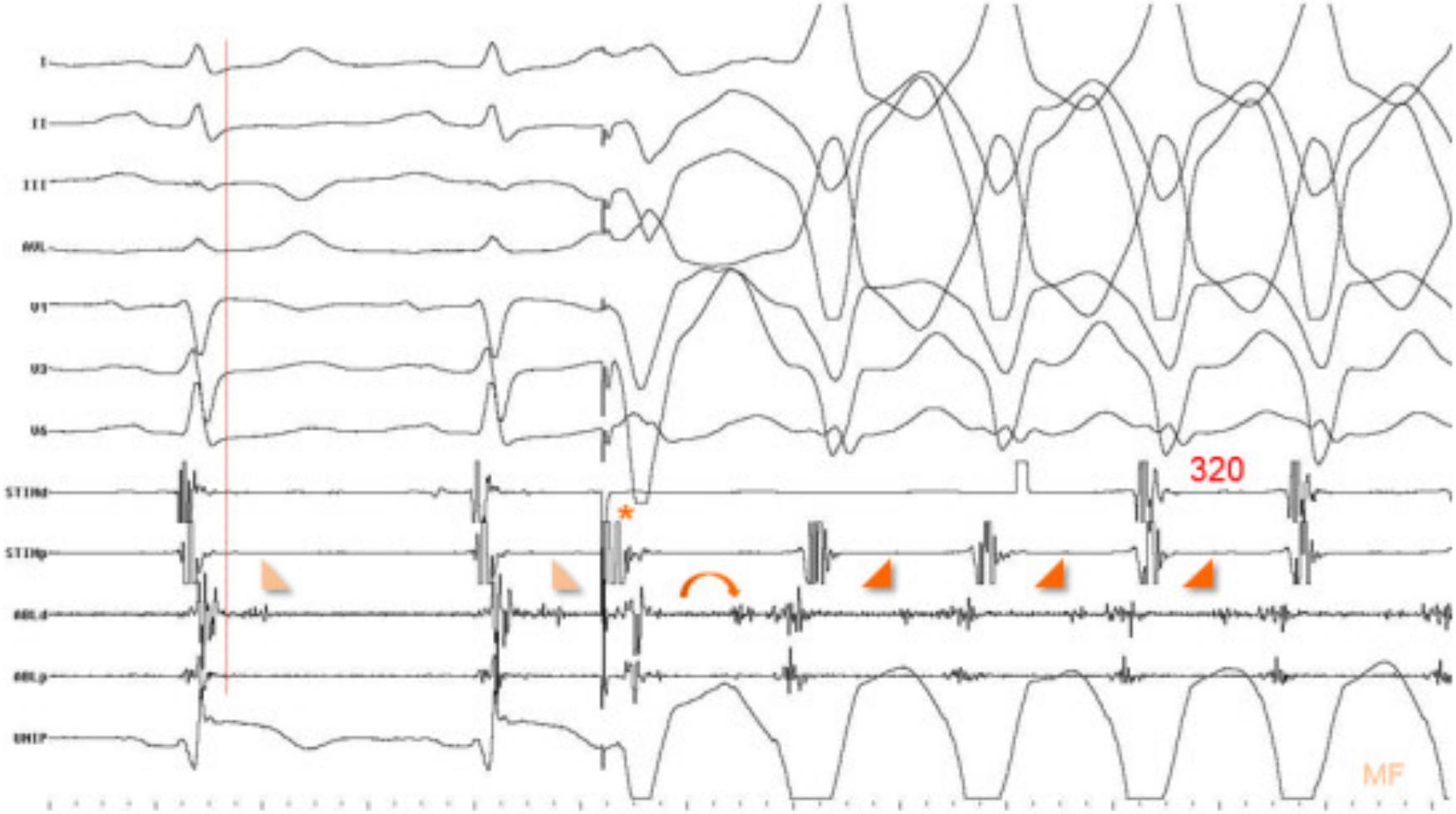




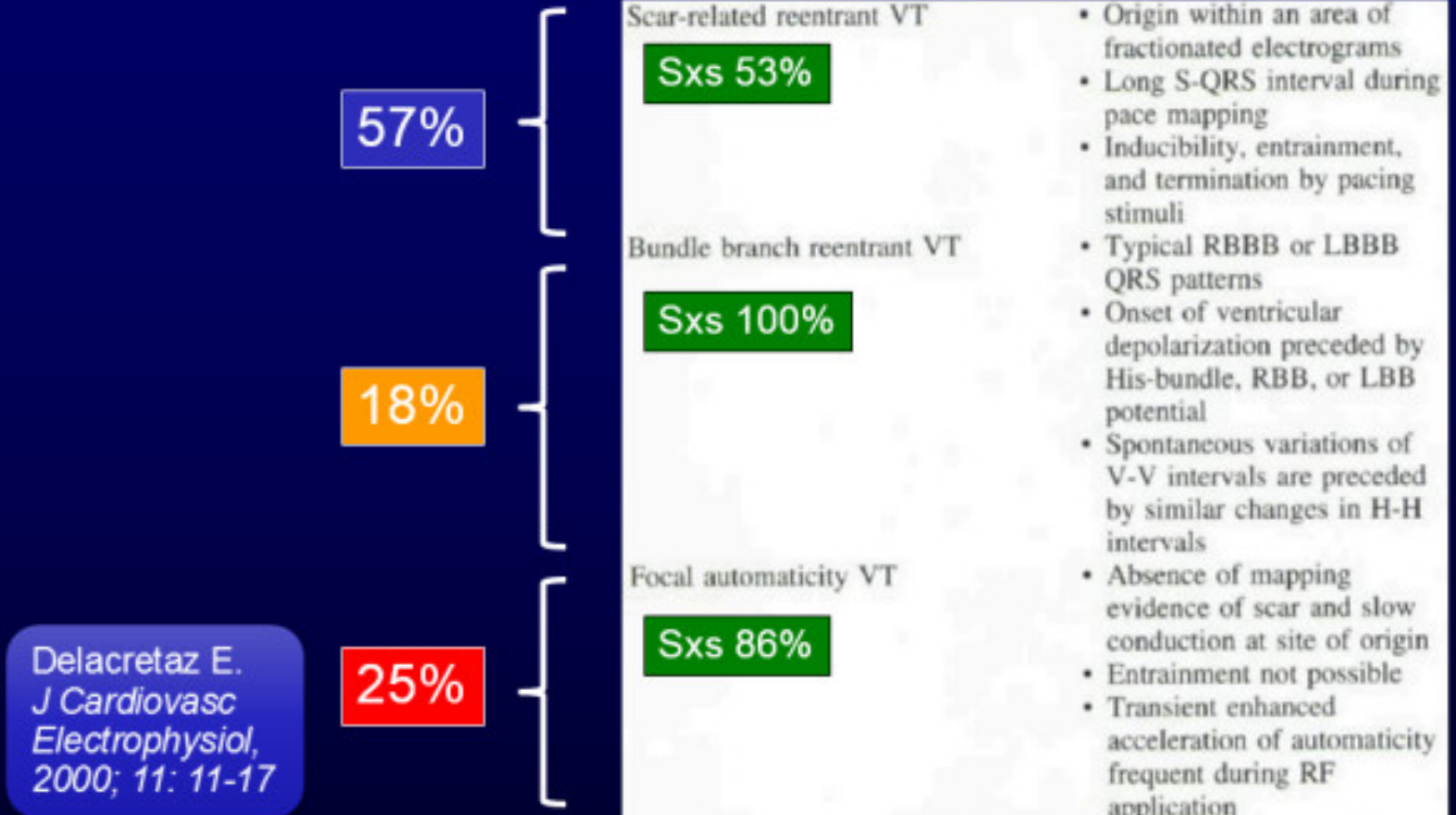
Masson's trichrome
stain of the same region


EPICARDIUM
Preserved Myocardium
Exit
SCAR
ENDOCARDIUM

Initiation of a Reentry VT



Three Different Mechanisms of VT in Non-Ischemic Cardiomyopathy

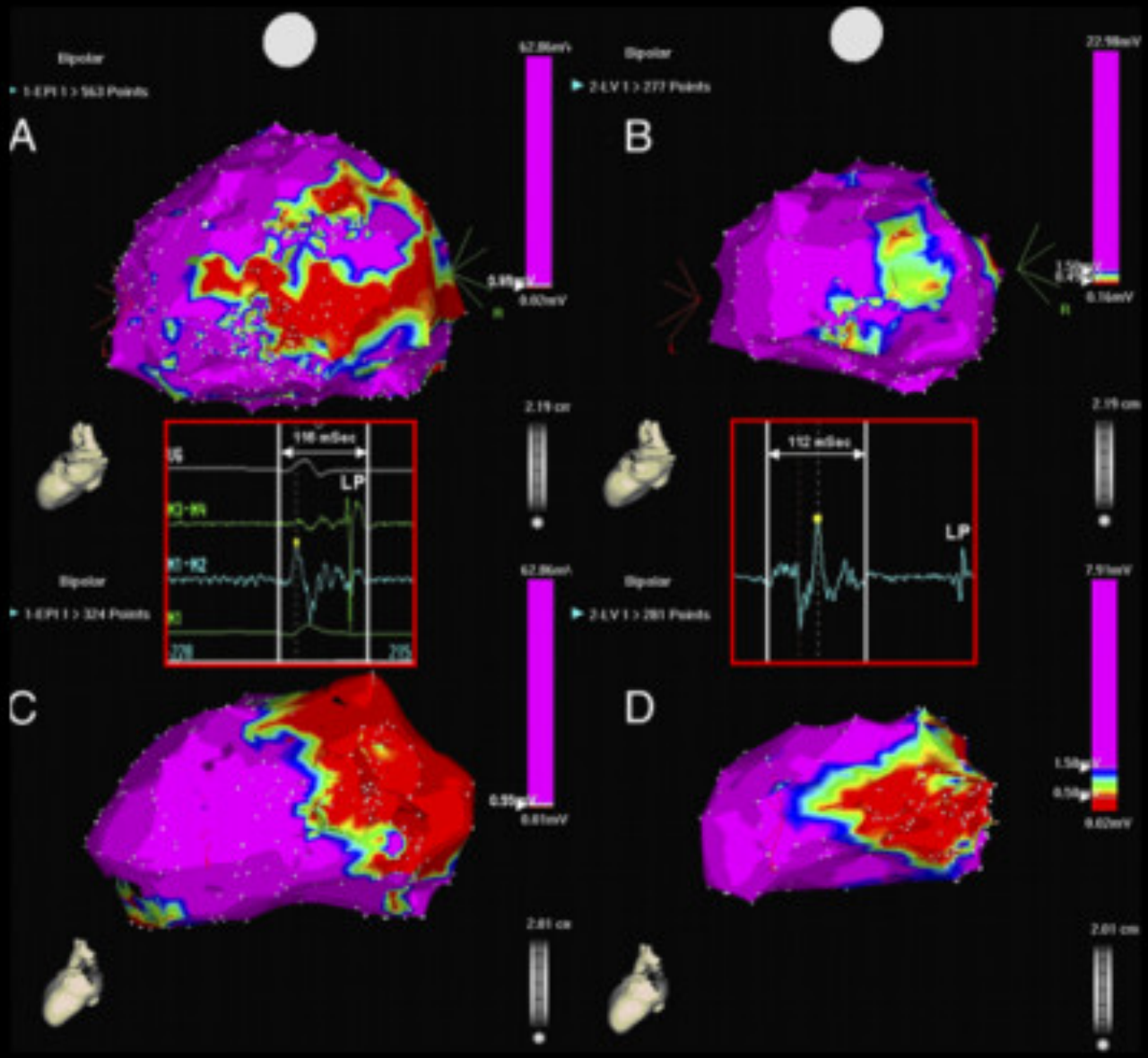


Delacretaz E. *J Cardiovasc Electrophysiol, 2000; 11: 11-17*

Epi and Endo LV Voltage Maps in NICM and Epicardial VT

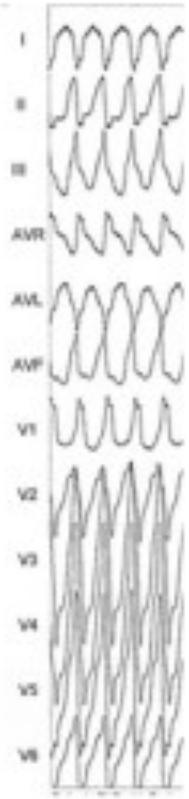
Postero-Anterior modified

Left-Lateral modified

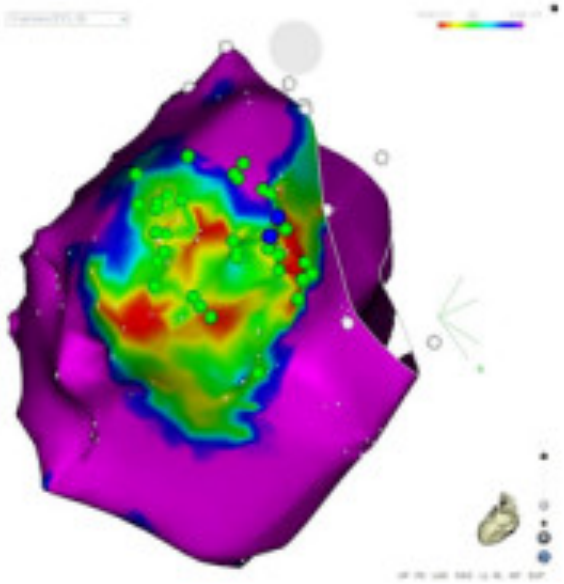


Mappaggio Endo-Epicardico In Paziente Con TV Post-Miocardite

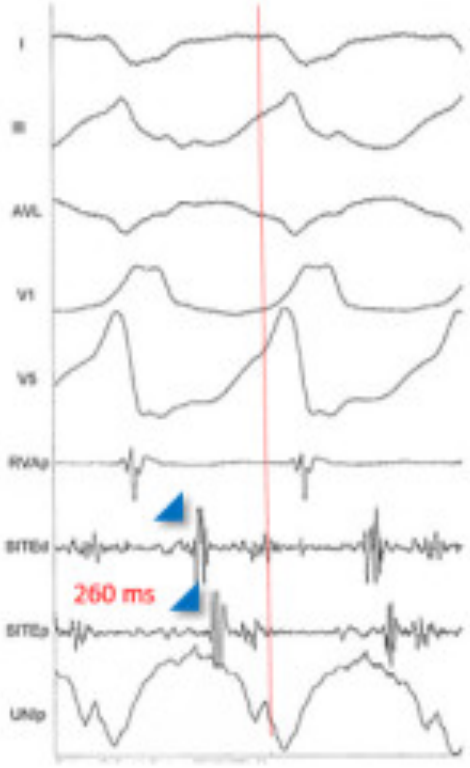
A



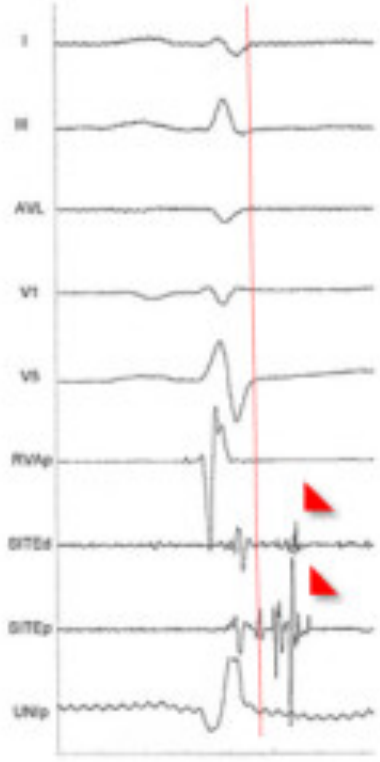
B



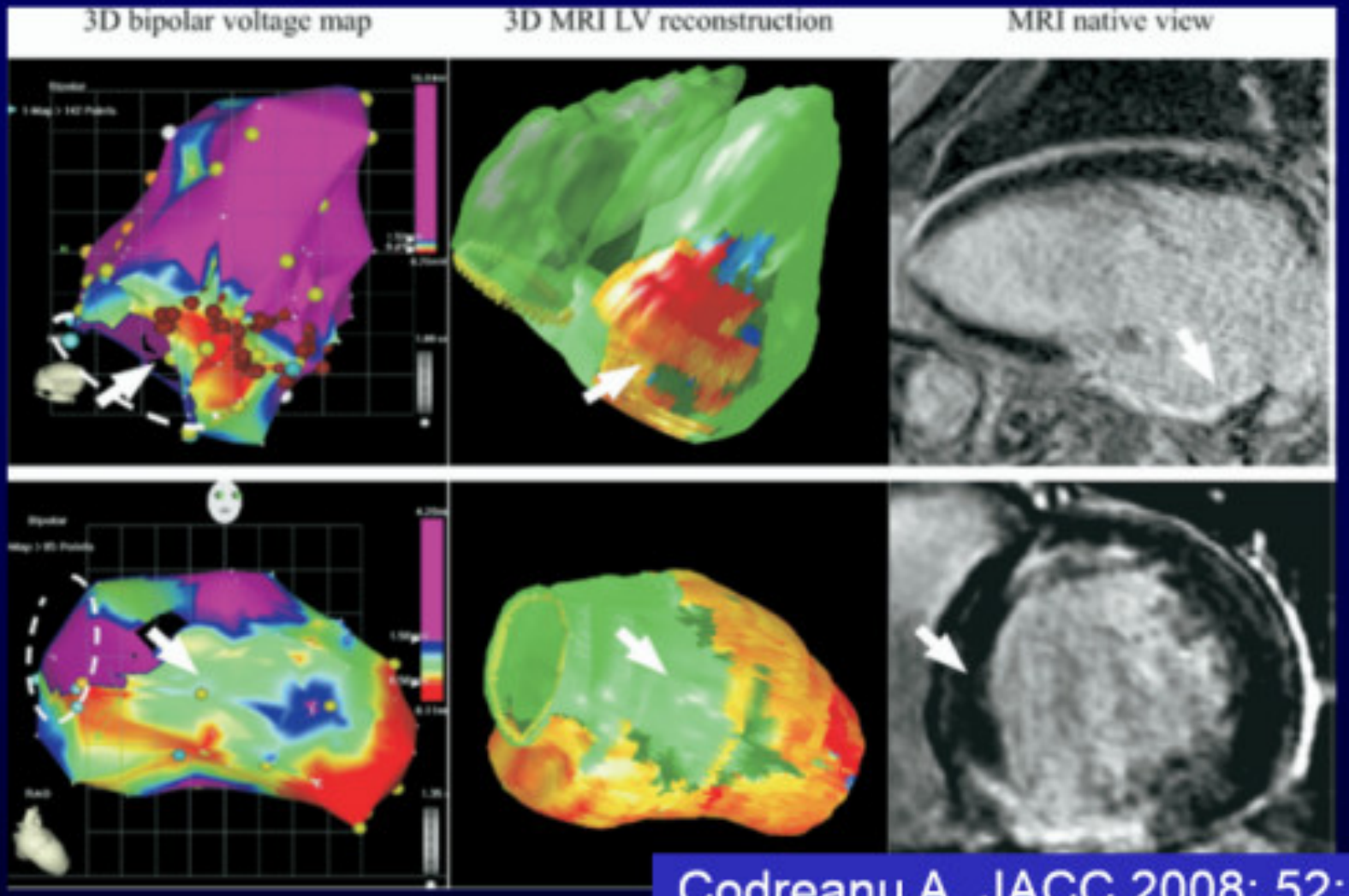
C



D



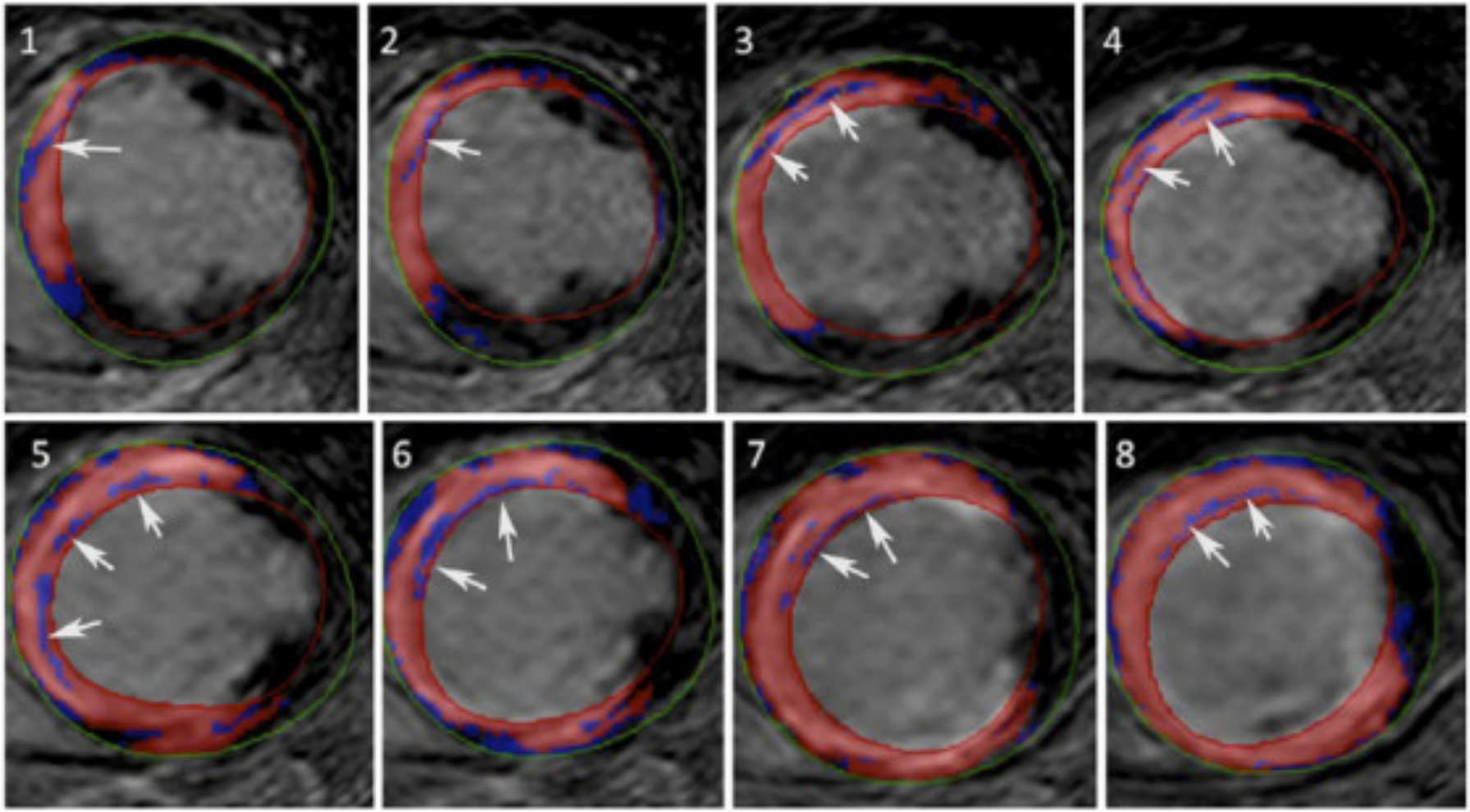
Mismatch in Scar Delineation Between CARTO Bipolar Maps and MRI Shells



Codreanu A. JACC 2008; 52: 839–42

Anteroseptal MI in a Patient with SMVT

Identification of Heterogeneous Tissue Channells



Perez-David E. J Am Coll Cardiol 2011; 57: 184–94

Mapping and Ablating VT
Basic Approaches

- Stable VT
  - activation plus entrainment mapping to identify exit sites and critical isthmuses/conduction channels
- Hemodynamic Unstable VT or Non-Inducible
  - substrate and pace mapping approaches combine identification of LPs and low amplitude, complex, fractionated EGMs with pacing from putative central isthmus and exit sites

Late Potentials Abolition as an Additional Technique for Reduction of Arrhythmia Recurrence in Scar Related Ventricular Tachycardia Ablation

Late Potential Abolition and Ventricular Tachycardia Inducibility at Programmed Stimulation After Radiofrequency Catheter Ablation

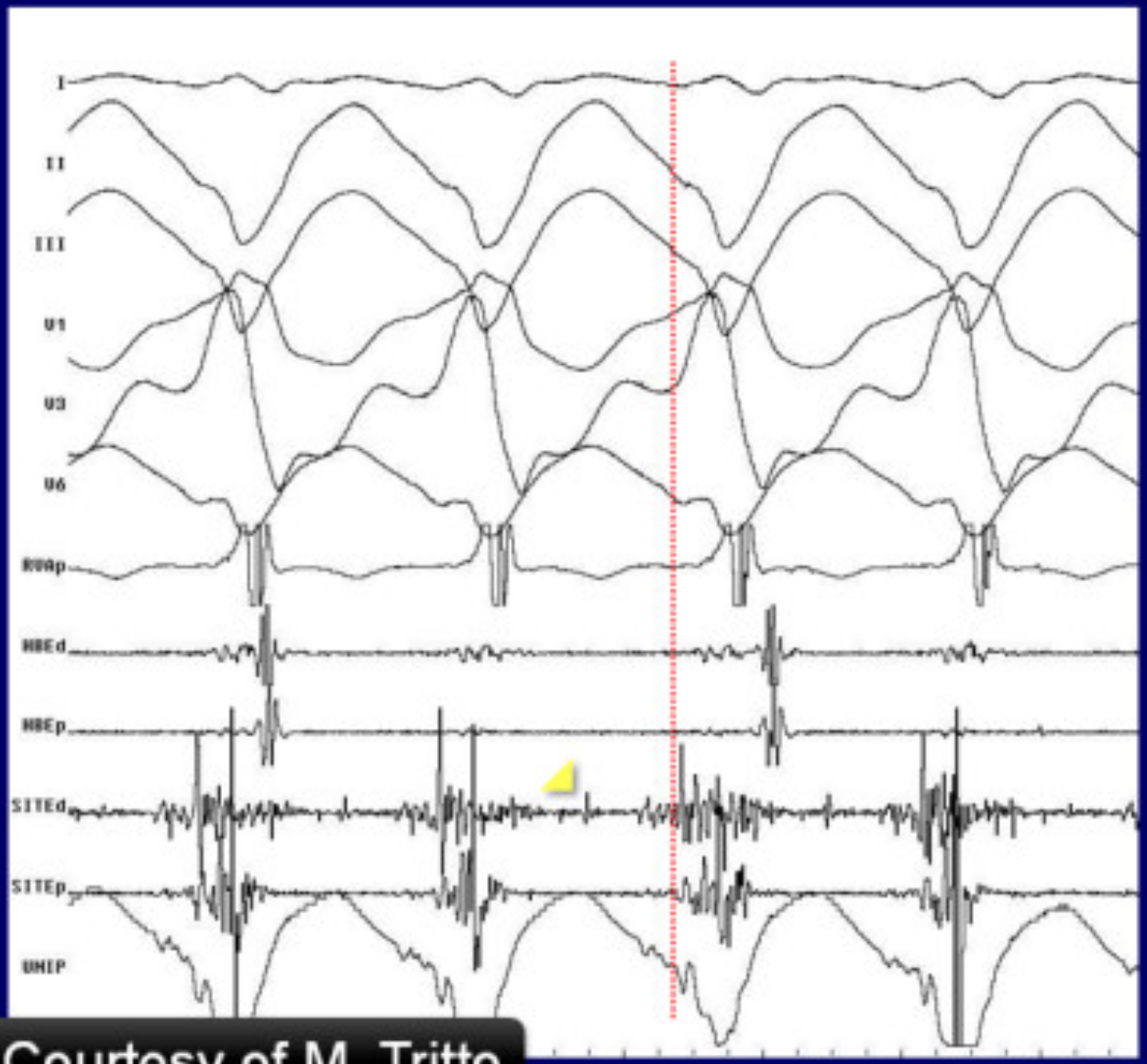
		Complete LP Abolition			
		Yes	No	Total	P value
VT inducibility after RFCA	Yes	5 (10.0%)	5 (10.0%)	10 (20.0%)	–
	No	37 (74.0%)	3 (6.0%)	40 (80.0%)	–
	Total	42 (84.0%)	8 (16.0%)	50 pts	P = 0.001
VT inducibility after RFCA in previously inducible pts	Yes	5 (14.3%)	5 (14.3%)	10 (28.6%)	–
	No	23 (65.7%)	2 (5.7%)	25 (71.4%)	–
	Total	28 (80.0%)	7 (20.0%)	35 pts	P = 0.005

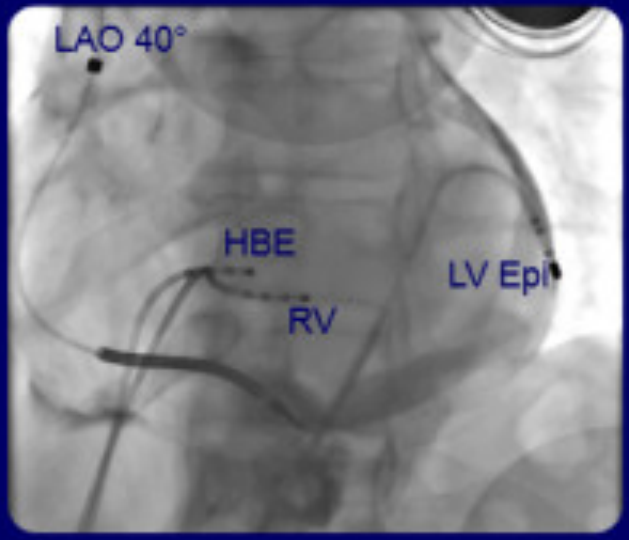
Arrhythmia Recurrence During the Follow-up in Relation with Complete LPs Abolition and VT Inducibility at Programmed Stimulation Immediately After the Ablation

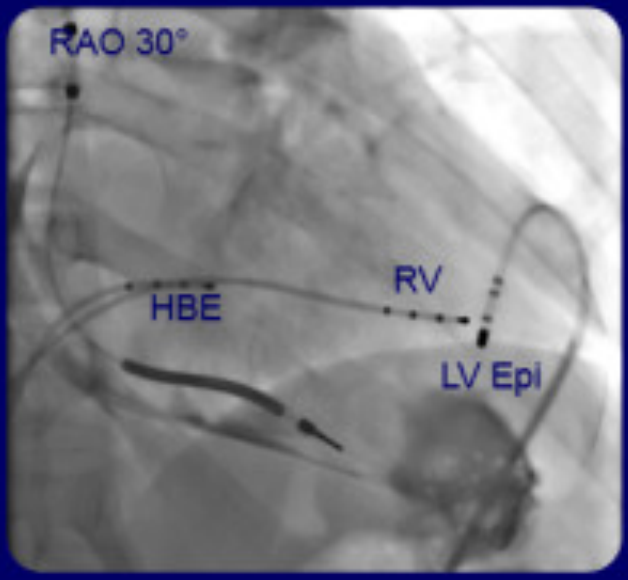
		VT Recurrence During Follow-up					
		Yes		No		Total	
		Pts	%	Pts	%	Pts	P value
Complete LP abolition	Yes (–)	4	9.5%	38	90.5%	42	P = 0.00002
	No	6	75%	2	25%	8	
VT inducibility after RFCA	No (–)	5	12.5%	35	87.5%	40	P = 0.008
	Yes	5	50.0%	5	50.0%	10	
Total		10	20.0%	40	80.0%	50	

Vergara P. J Cardiovasc Electrophysiol 2012; 23: 621-627

Epicardial Mapping During VT







Courtesy of M. Tritto

Epicardial Ablation

- RF-CA of VT via an endocardial approach is generally unsuccessful in 20-40% of post-MI pts
- 15% of these pts have at least one VT originating from the epicardium
- Inferior wall MI, in particular, is associated with epicardial reentry circuits
- In non-ICMs, as many as 70% of VTs may have epicardial origin
- The utilization of epicardial approach appears lower in non-ICMs

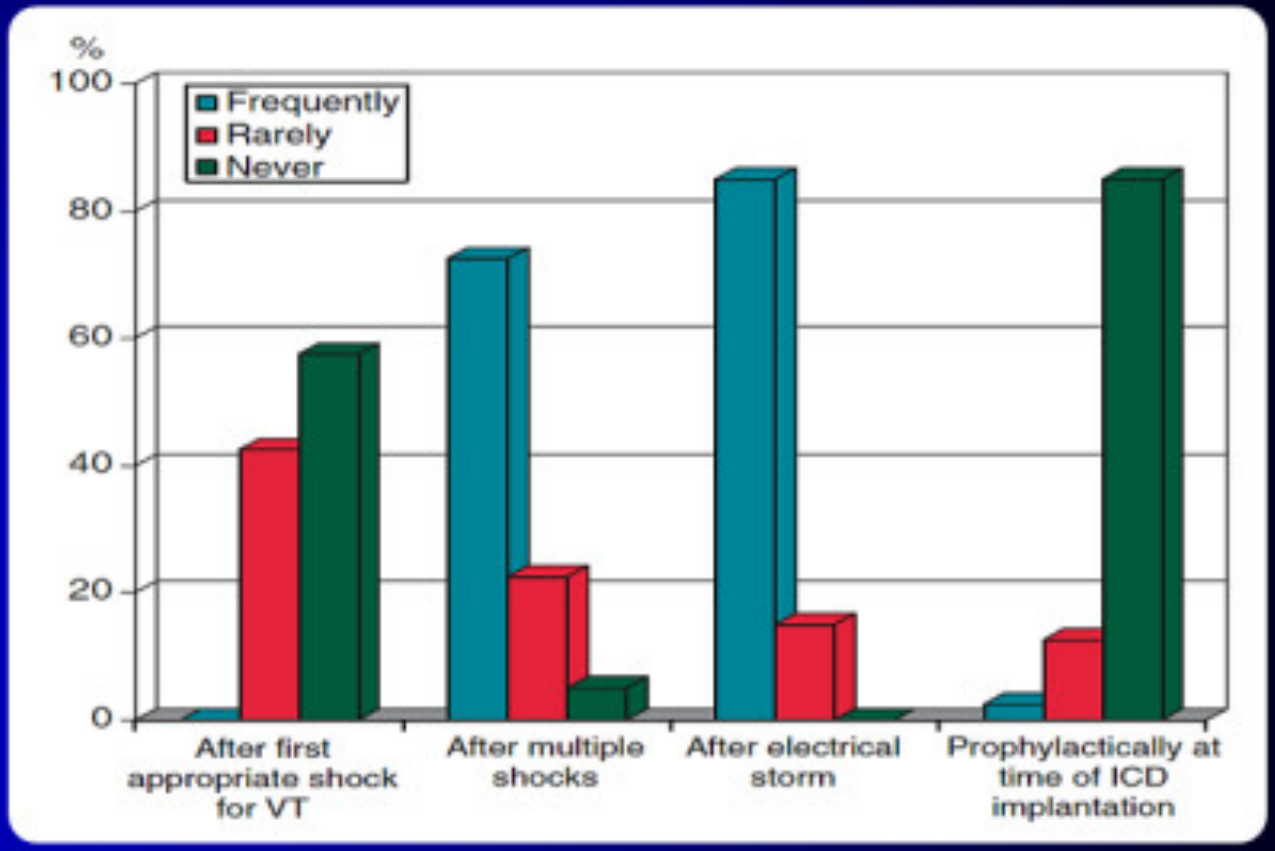
Europace (2012) 14, 135–137
doi:10.1093/europace/eur411

EP WIRE

Current practice of ventricular tachycardia ablation in patients with implantable cardioverter-defibrillators

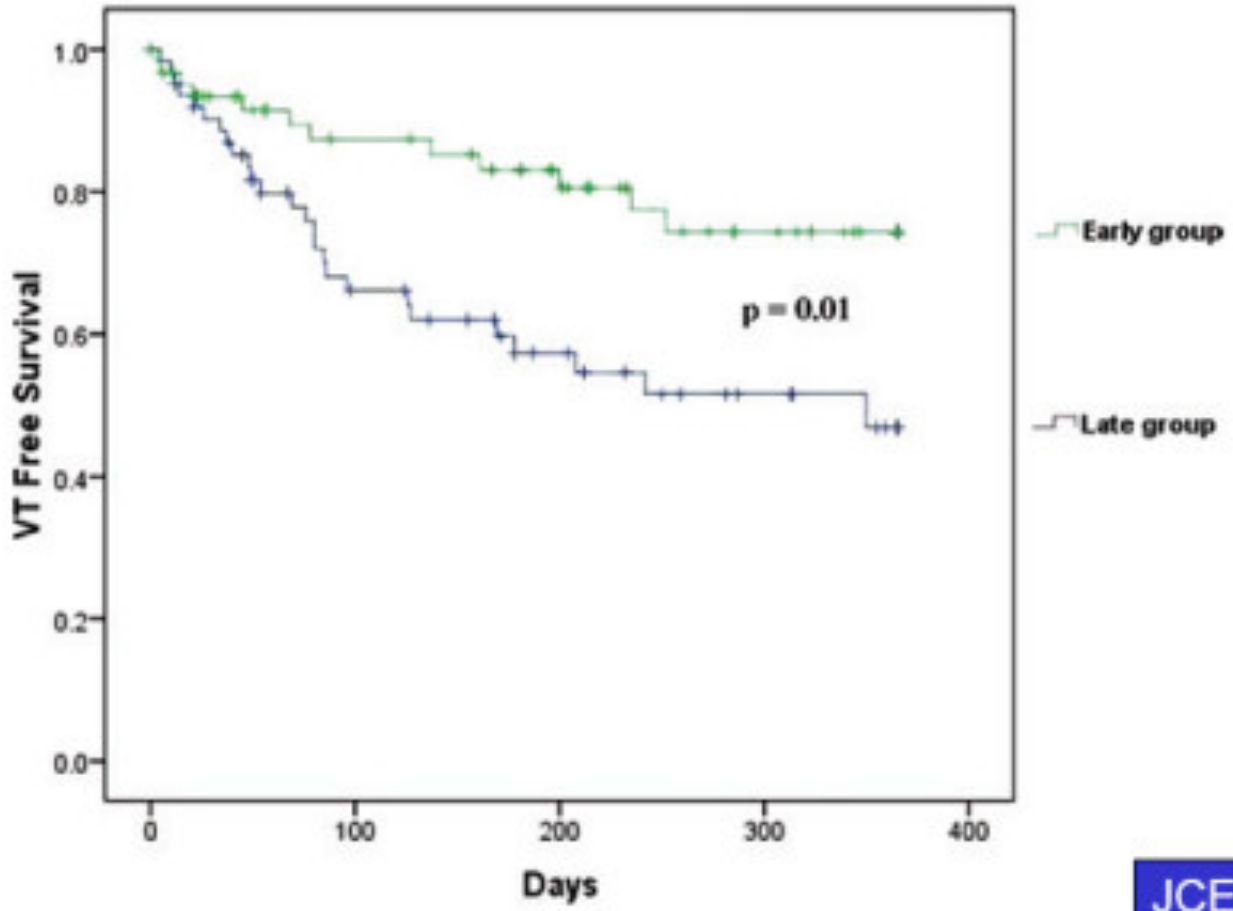
Nikolaos Dagres[1*], Francesco Cantù[2], Peter Geelen[3], Thorsten Lewalter[4], Alessandro Proclemer[5], and Carina Blomström-Lundqvist[6]

- 40 European Centers
- 17 Countries
- #CA per year
  - <10: 30%
  - 10-30: 57%
  - >30: 13%



Ventricular Tachycardia Ablation Remains Treatment of Last Resort in Structural Heart Disease: Argument for Earlier Intervention

DAVID S. FRANKEL, M.D., STAVROS E. MOUNTANTONAKIS, M.D., MELISSA R. ROBINSON, M.D., ERICA S. ZADO, P.A.-C., DAVID J. CALLANS, M.D., and FRANCIS E. MARCHLINSKI, M.D.



JCE 2011;22:1123-8

VT Ablation

Take Home Messages

- Improvement in the understanding of the pathophysiology of VT, has enhanced the efficacy of CA procedures
- Device therapies for VT diminish the QoL
- Earlier CA should be considered for pts with recurrent VT and ICD therapies.
- New technology is emerging to enhance ablation success.