

# Epicardial Ablation in Brugada Syndrome

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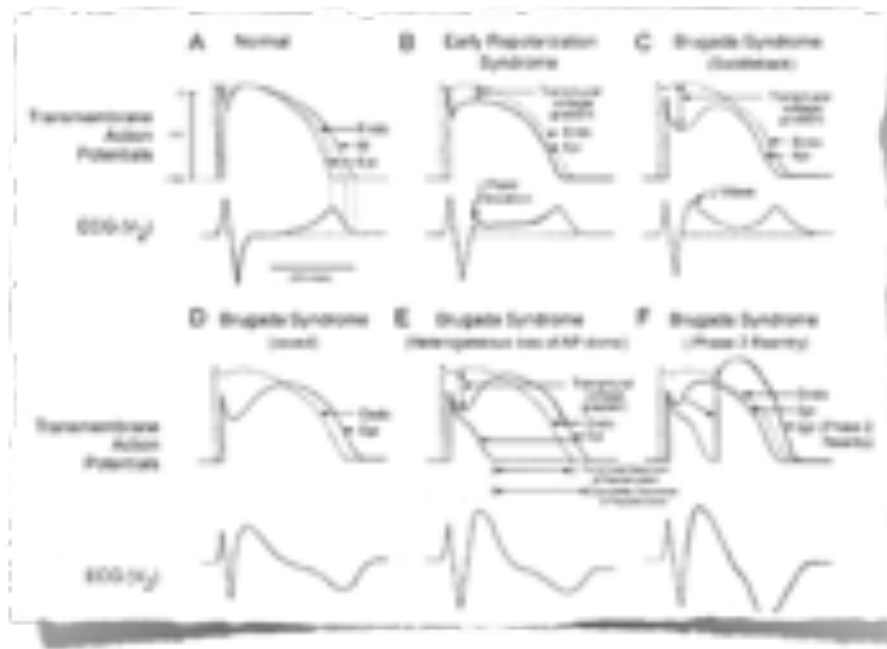
## ●●● INTRODUCTION

- Brugada Syndrome is an inherited cardiac disease
- Increased risk of sudden cardiac death owing to ventricular arrhythmias
- Absence of structural heart disease
- Characteristic ECG pattern is the cornerstone of its diagnosis



# ●●● PATHOPHYSIOLOGICAL MECHANISM(S)

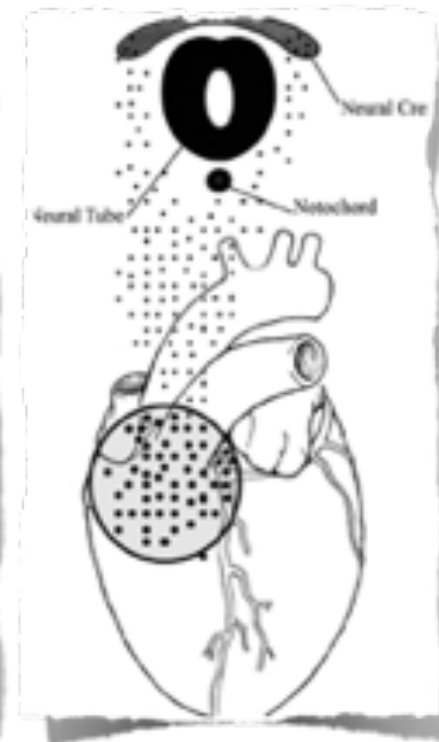
→ Conduction disease, depolarization disorder, repolarization disorder, developmental defect ?



*J Cardiovasc Electrophysiol* 2001;12:268



*Cardiovasc Res* 2005;67:367



*Heart Rhythm* 2007;4:359

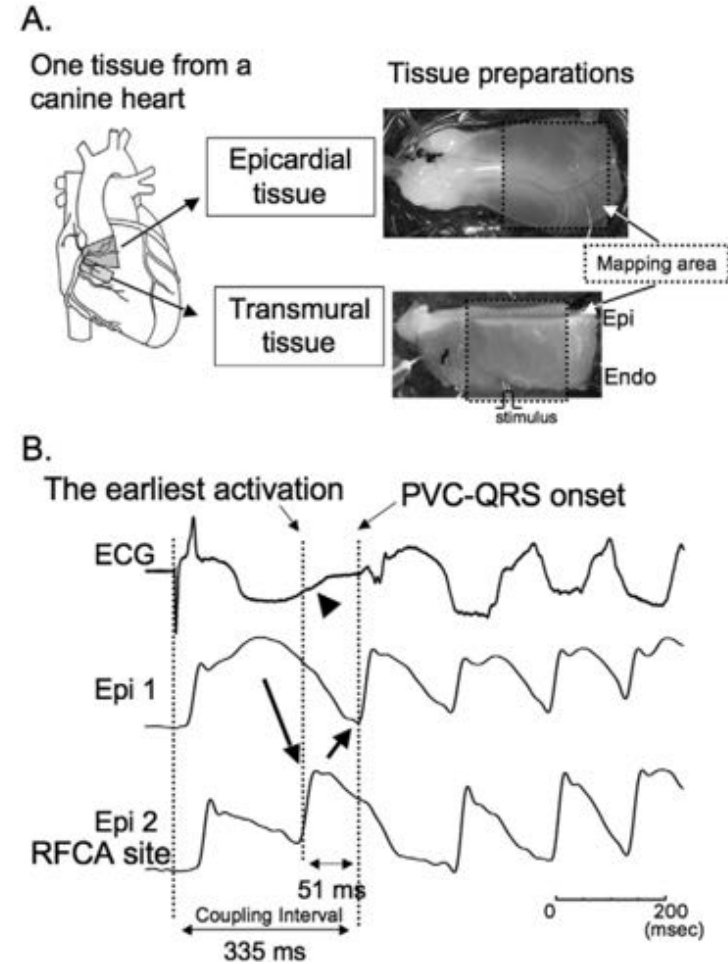
# EPICARDIAL ABLATION ELIMINATES VENTRICULAR ARRHYTHMIAS IN EXPERIMENTAL MODEL OF BRUGADA SYNDROME

Examples of epicardial and transmural tissue preparations

(pilsicainide and pinacidil)(A) and phase 2 reentry and site of ablation (B).

(A) Tissues were perfused arterially at 36.5°C. Electrical activities were mapped on the epicardium or on a cut-exposed transmural surface.

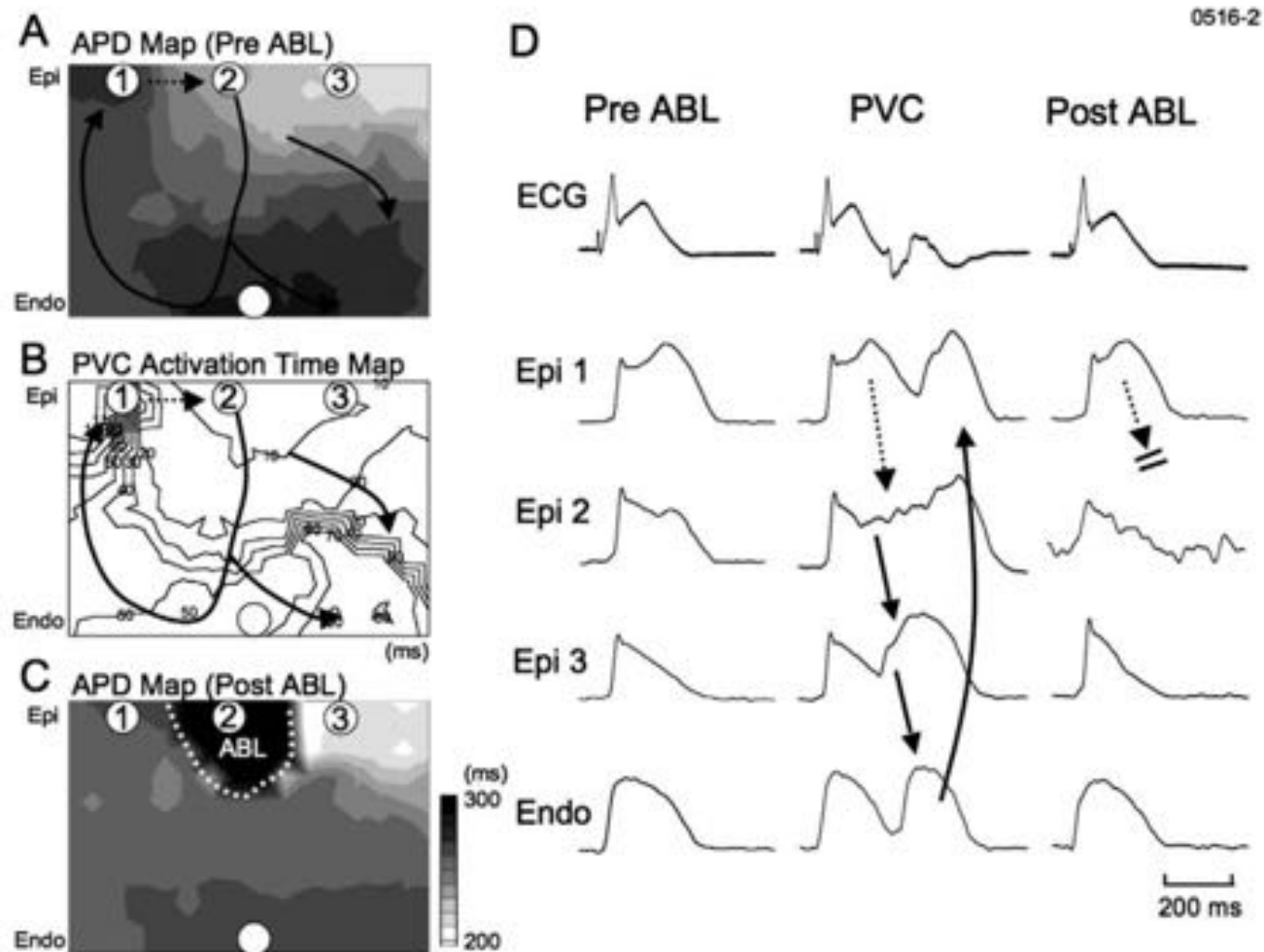
(B) After induction of Brugada syndrome model, the phase 2 dome of AP conducted from the region having a prominent dome (Epi1) to the region without a dome (Epi2) initiated arrhythmia. Arrows show phase 2 reentry.



Morita H. Heart Rhythm 2009;6:665 -671



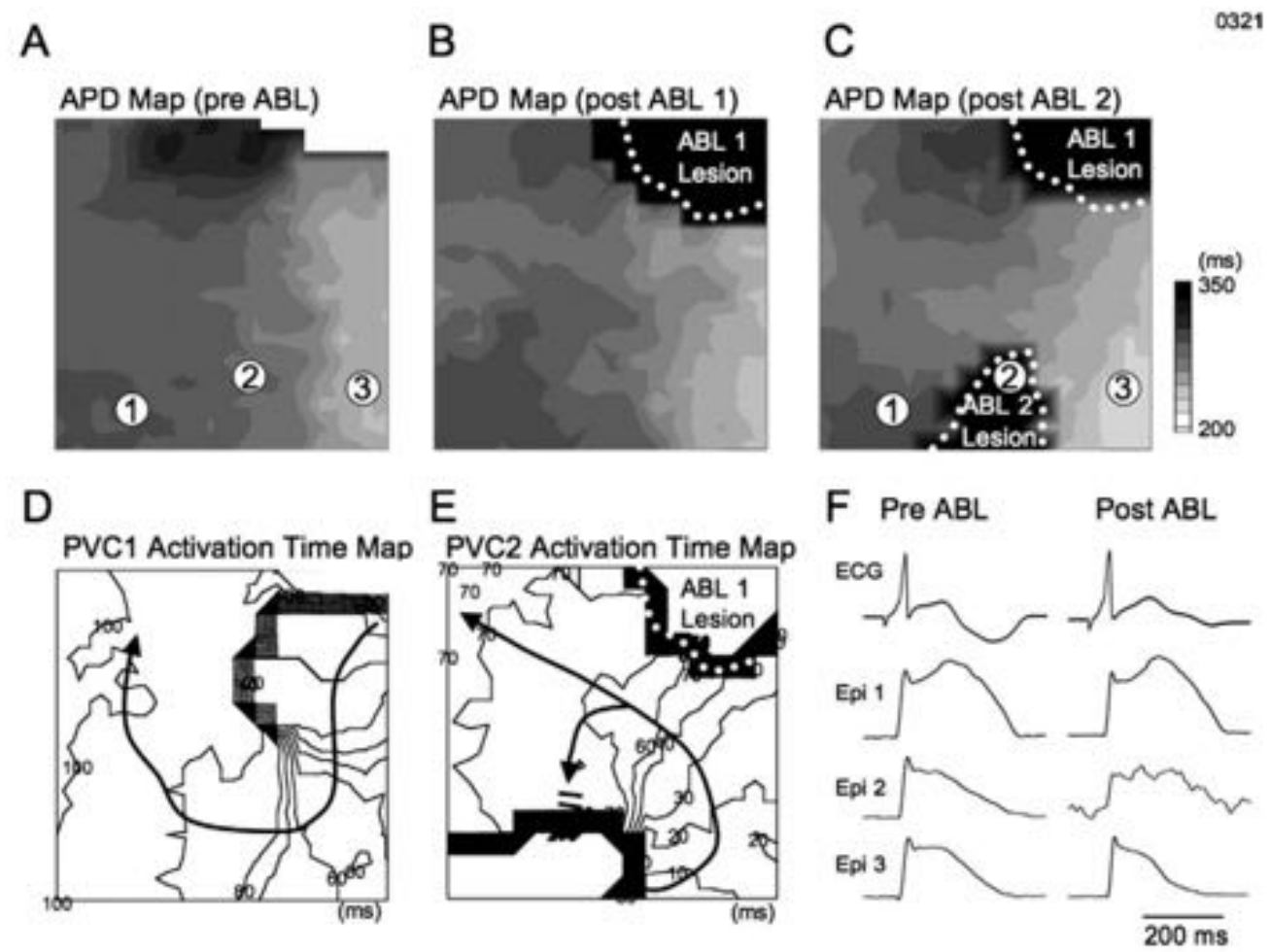
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Morita H. Heart Rhythm 2009;6:665 -671



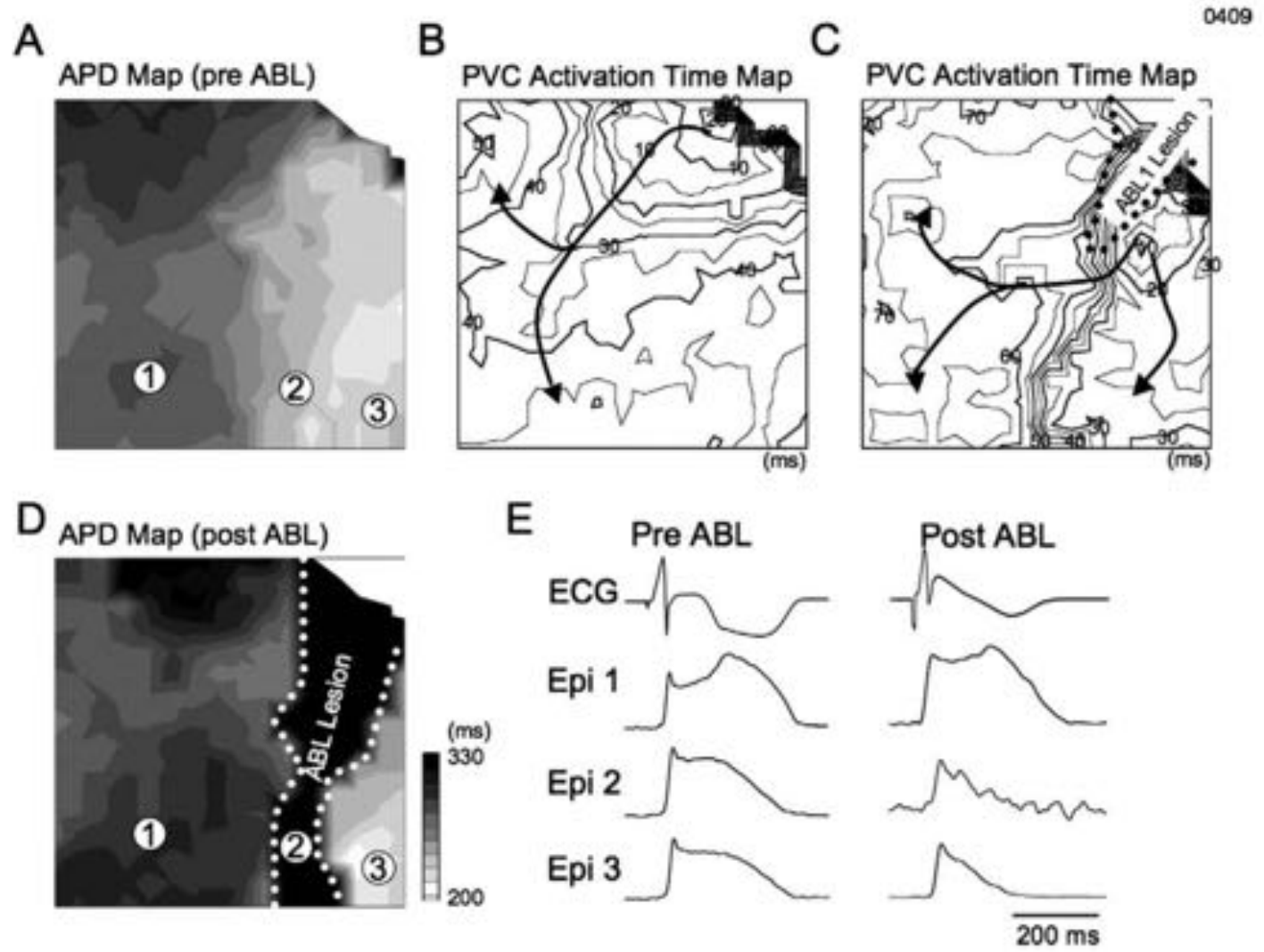
# EPICARDIAL ABLATION ELIMINATES VENTRICULAR ARRHYTHMIAS IN EXPERIMENTAL MODEL OF BRUGADA SYNDROME



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# EPICARDIAL ABLATION ELIMINATES VENTRICULAR ARRHYTHMIAS IN EXPERIMENTAL MODEL OF BRUGADA SYNDROME



## ●●● EPICARDIAL ABLATION ELIMINATES VENTRICULAR ARRHYTHMIAS IN EXPERIMENTAL MODEL OF BRUGADA SYNDROME

**These experimental observations suggest that RFCA applied to the EPI may be more effective than applied to the ENDO in eliminating VT in patients with BS.**



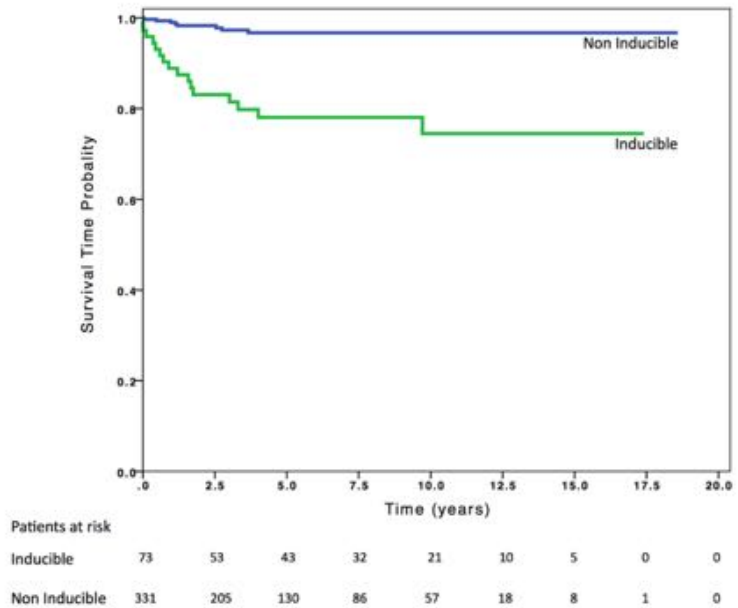
# ●●● SELECTION OF PATIENTS FOR EPICARDIAL ABLATION

- Global risk: 1.6-1.3%
- Risk Factors:
  - Consistently associated
    - Spontaneous type I ECG
    - Symptoms
  - Less agreed:
    - VA induction in EPS
- Added value of novel risk factors not proven
- Absence of a comprehensive risk stratification strategy

# VALUE OF EPS

## Prognostic Value of Programmed Electrical Stimulation in Brugada Syndrome 20 Years Experience

Juan Sicra, MD; Giulio Conte, MD; Giuseppe Ciconte, MD; Carlo de Asmundis, MD;  
Gian-Battista Chierchia, MD; Giannis Baltogiannis, MD; Giacomo Di Giovanni, MD;  
Yukio Saitoh, MD; Ghazala Irfan, MD; Ruben Casado-Arroyo; Justo Juliá, MD;  
Mark La Meir, MD; Francis Wellens, MD; Kristel Wauters, MD; Sophie Van Malderen, MD;  
Gudrun Pappaert, RN; Pedro Brugada, MD



# ●●● GLOBAL RISK STRATIFICATION

## A Score Model to Predict Risk of Events in BS



European Heart Journal (2017) **38**, 1756–1763  
doi:10.1093/eurheartj/ehx119

**CLINICAL RESEARCH**  
Arrhythmia/electrophysiology

### A score model to predict risk of events in patients with Brugada Syndrome

**Juan Sieira<sup>1\*</sup>, Giulio Conte<sup>1</sup>, Giuseppe Ciconte<sup>1</sup>, Gian-Battista Chierchia<sup>1</sup>, Ruben Casado-Arroyo<sup>1</sup>, Giannis Baltogiannis<sup>1</sup>, Giacomo Di Giovanni<sup>1</sup>, Yukio Saitoh<sup>1</sup>, Justo Juliá<sup>1</sup>, Giacomo Mugnai<sup>1</sup>, Mark La Meir<sup>2</sup>, Francis Wellens<sup>2</sup>, Jens Czapla<sup>2</sup>, Gudrun Pappaert<sup>1</sup>, Carlo de Asmundis<sup>1†</sup>, and Pedro Brugada<sup>1†</sup>**

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# GLOBAL RISK STRATIFICATION

## A Score Model to Predict Risk of Events in BS

	n = 400
Age, years	41.1 ± 17.8
Male sex, n (%)	233 (58.3)
Spontaneous type I, n (%)	78 (19.5)
SCD, n (%)	20 (5.0)
Syncope, n (%)	111 (27.8)
Asymptomatic, n (%)	269 (67.3)
Proband, n (%)	122 (30.5)
Family history of SCD, n (%)	184 (46.0)
Family history of SCD <35y, n (%)	31 (7.8)
Previous SND, n (%)	8 (2.0)
PES inducible	72 (19.7)

# ●●● GLOBAL RISK STRATIFICATION

## A Score Model to Predict Risk of Events in BS

- Mean follow-up:  $80.7 \pm 57.2$  months
- Arrhythmic events: 34 (8.5%)
  - 4 SCD
  - 30 appropriate ICD shocks
- Incidence rate: 1.4%/year

# GLOBAL RISK STRATIFICATION

A Score Model to Predict Risk of Events in BS

	HR	95% CI	p
SCD	20.0	8.1 – 49.4	p<0.01
Syncope	3.7	1.6 – 8.6	p<0.01
Type I	2.7	1.3 – 5.4	p<0.01
Men	2.7	1.2 – 6.2	p=0.02
Early familial SCD	2.9	1.2 – 7.0	p=0.02
SND	5.0	1.5 – 16.3	P<0.01
EPS	4.7	2.2 – 10.2	p<0.01
Proband	2.1	1.0 – 4.2	p=0.04

# ●●● GLOBAL RISK STRATIFICATION

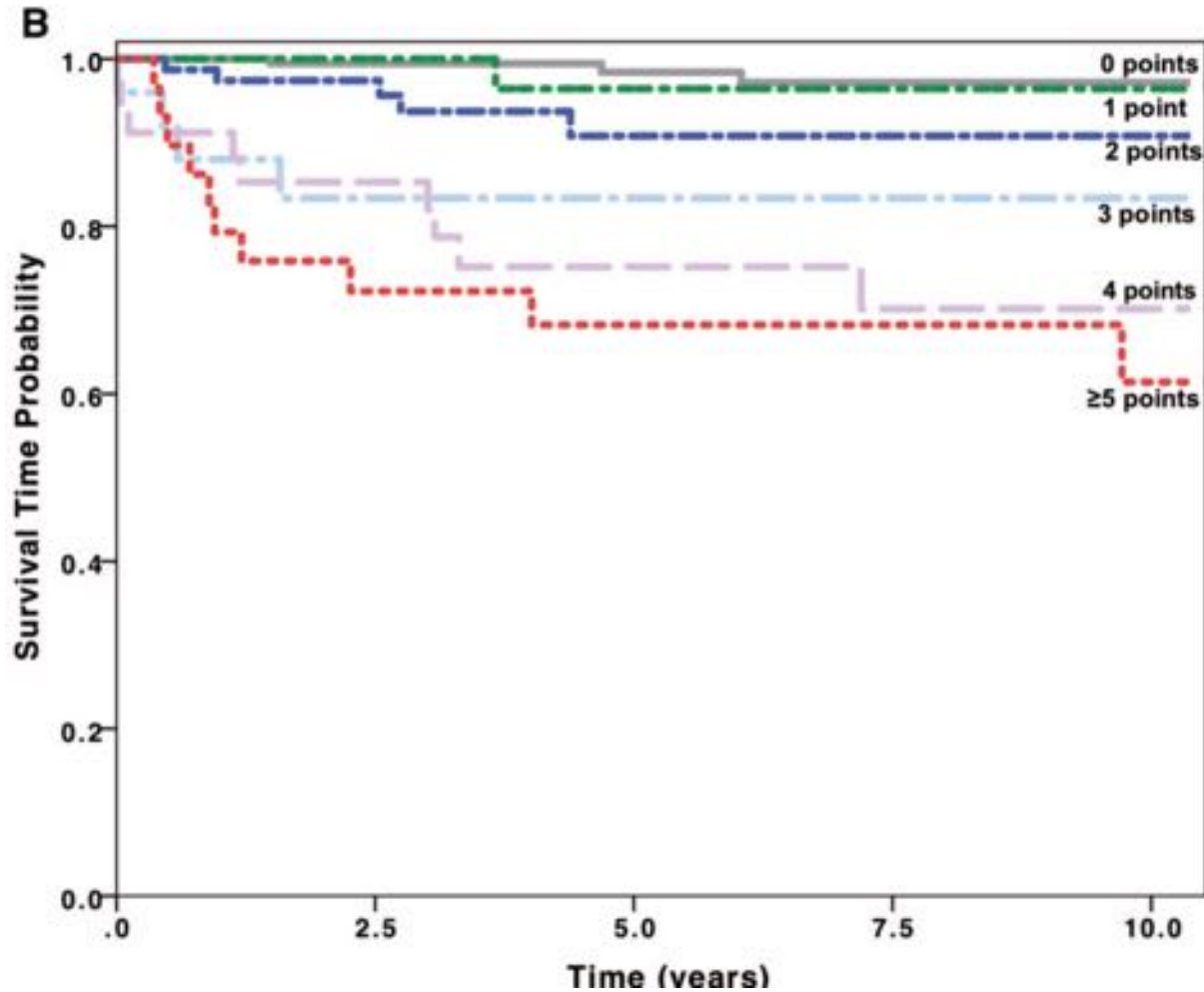
A Score Model to Predict Risk of Events in BS

Item	Points
Spontaneous type I	1
Early familial SCD	1
Inducible EPS	2
Syncope	2
SND	3
SCD	4

- Predictive ability:
  - Overall: 0.82
  - Asymptomatic: 0.81
  - Validating cohort: 0.81

# GLOBAL RISK STRATIFICATION

A Score Model to Predict Risk of Events in BS



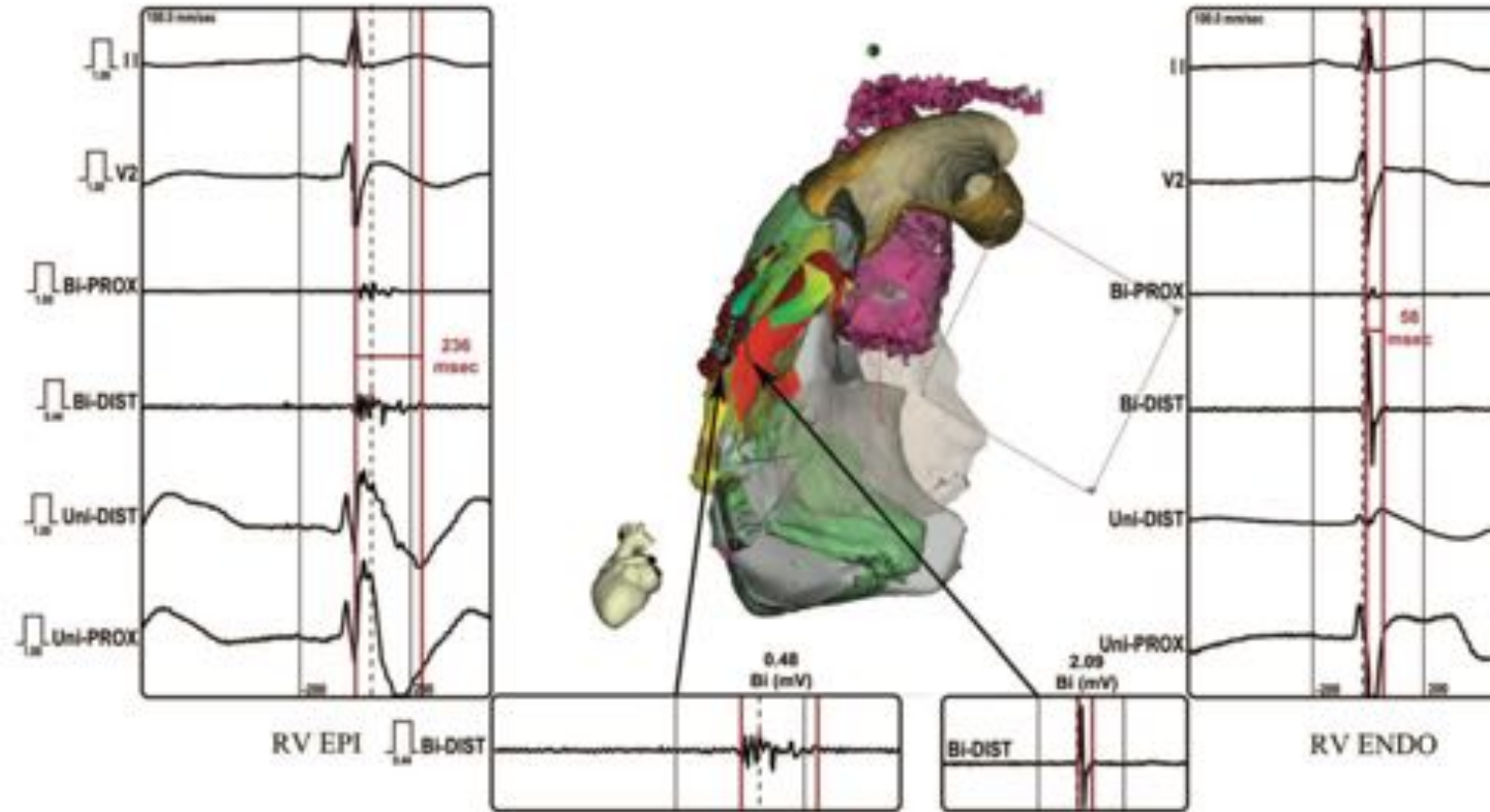
Score	1 year	5 years	10 years	p value
0	100 %	98.4%	97.2 %	
1	100 %	96.4 %	96.4 %	0.79
2	97.4 %	90.8 %	90.8 %	0.02
3	88.7 %	83.4 %	83.4 %	<0.01
4	91.2 %	75.2 %	70.1 %	<0.01
≥ 5	79.3 %	68.2 %	61.4 %	<0.01



## ●●● THERAPEUTIC OPTIONS

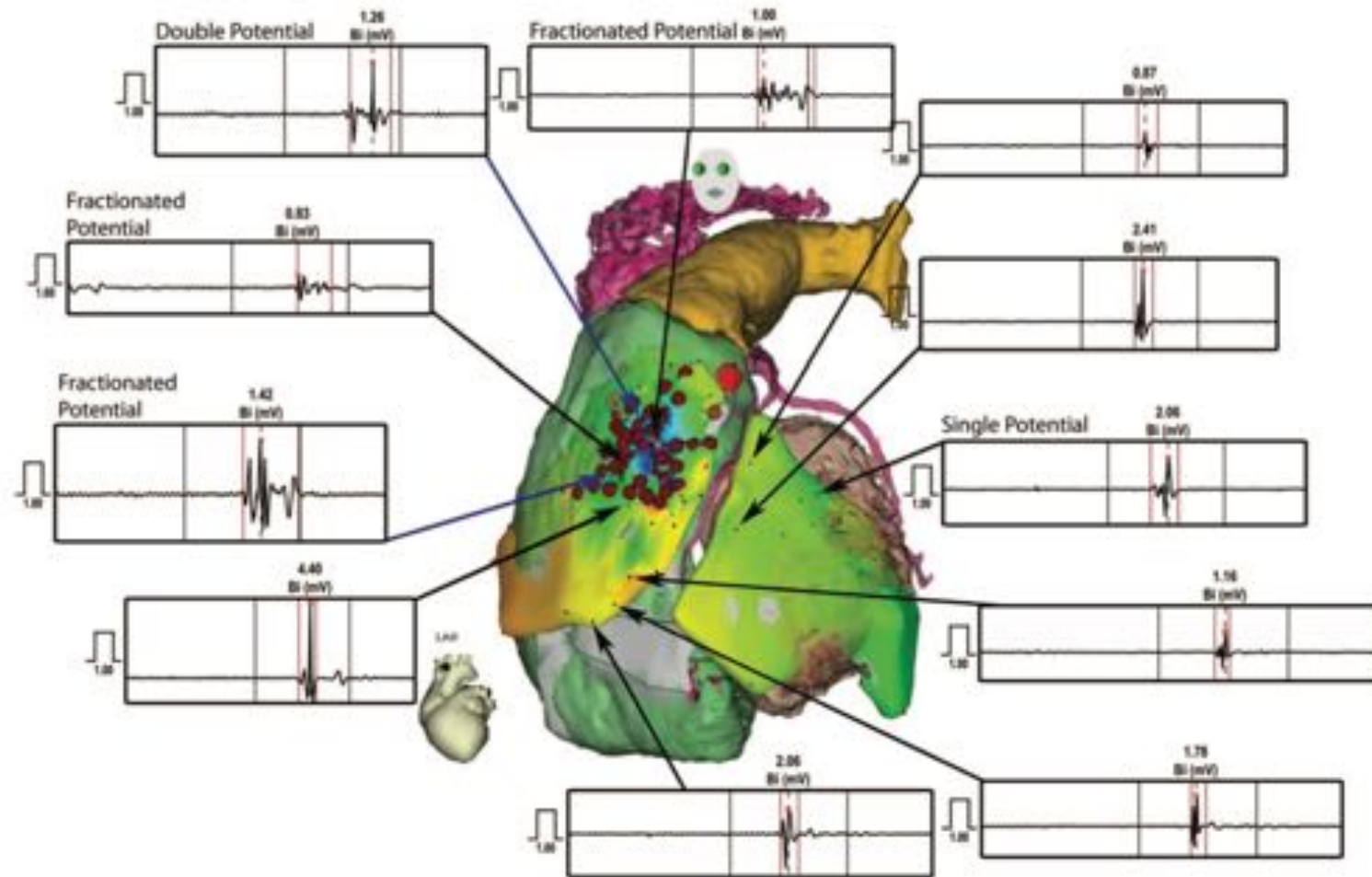
- ICD implantation
- Quinidine
- Epicardial ablation

# ●●● ABLATION OVER THE ANTERIOR RIGHT VENTRICULAR OUTFLOW TRACT EPICARDIUM



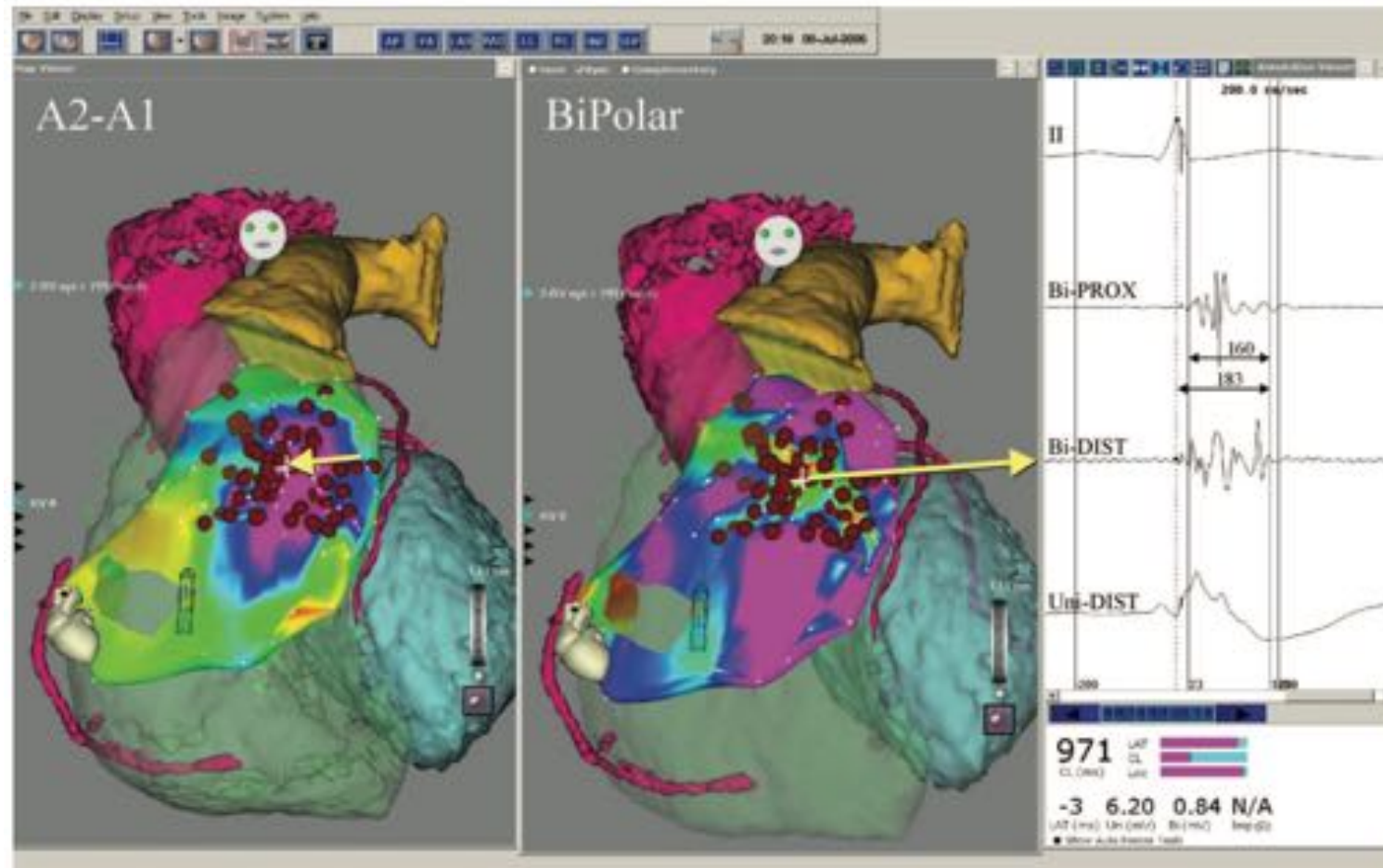
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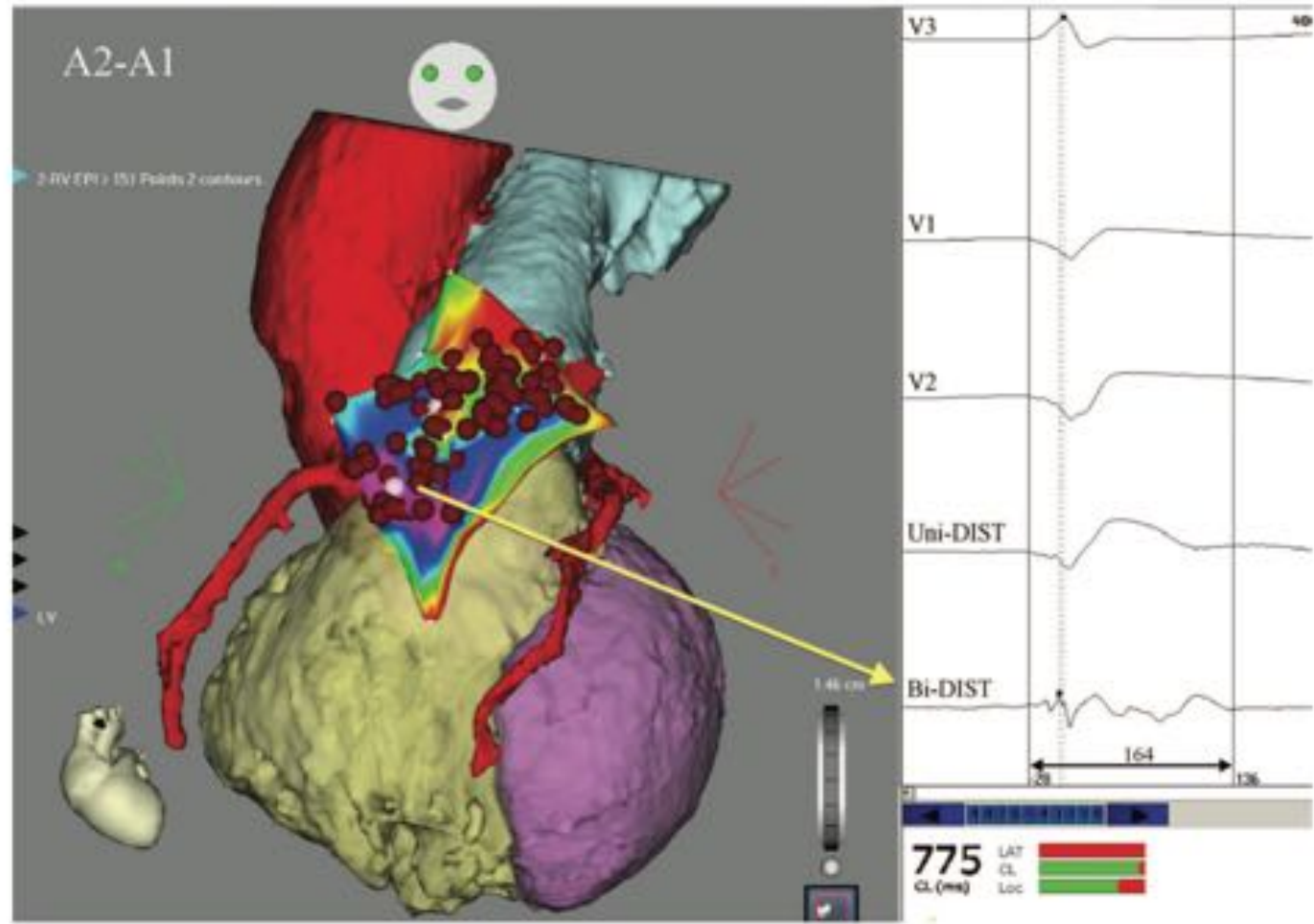


Nademanee K Circulation. 2011;123:1270-1279

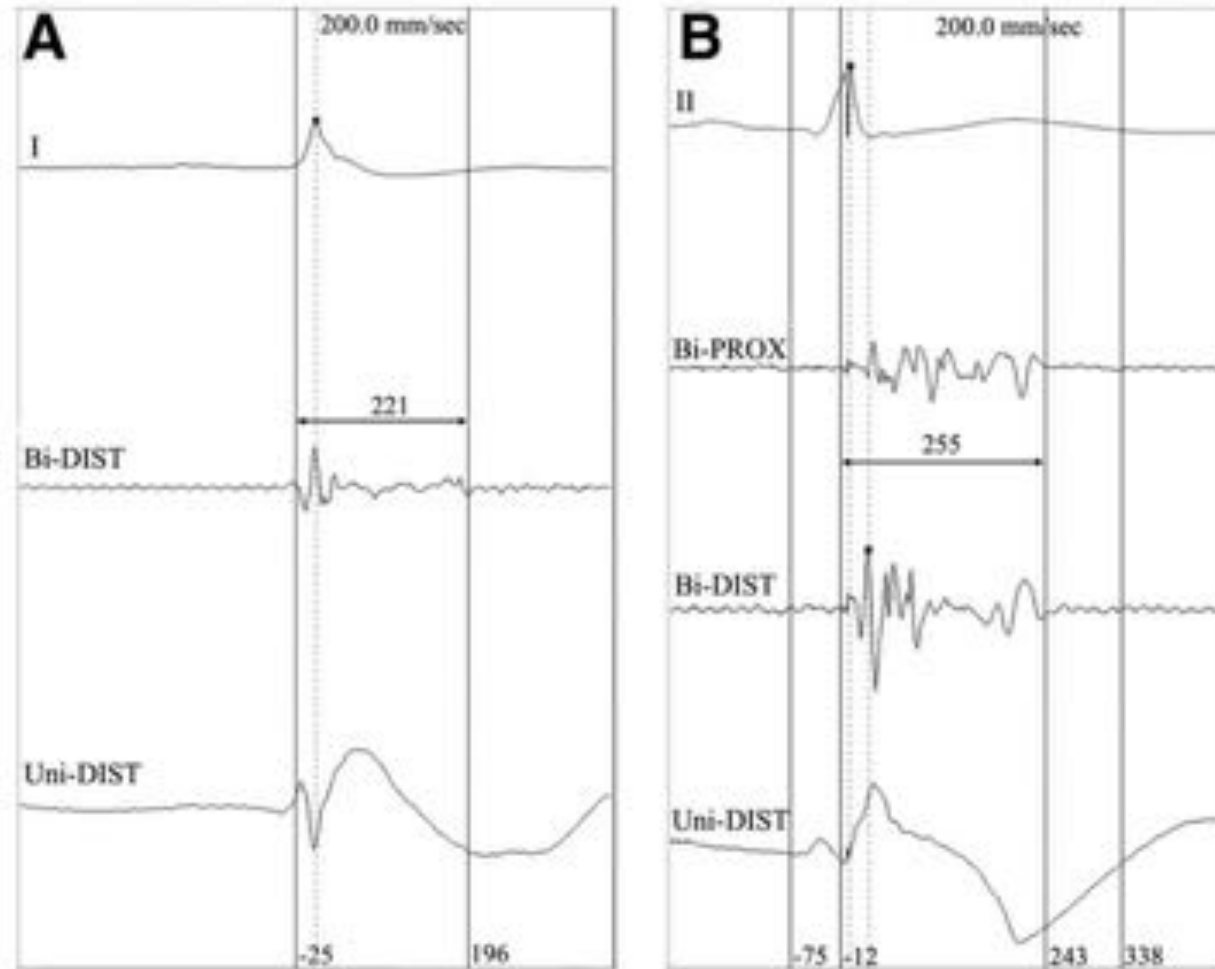
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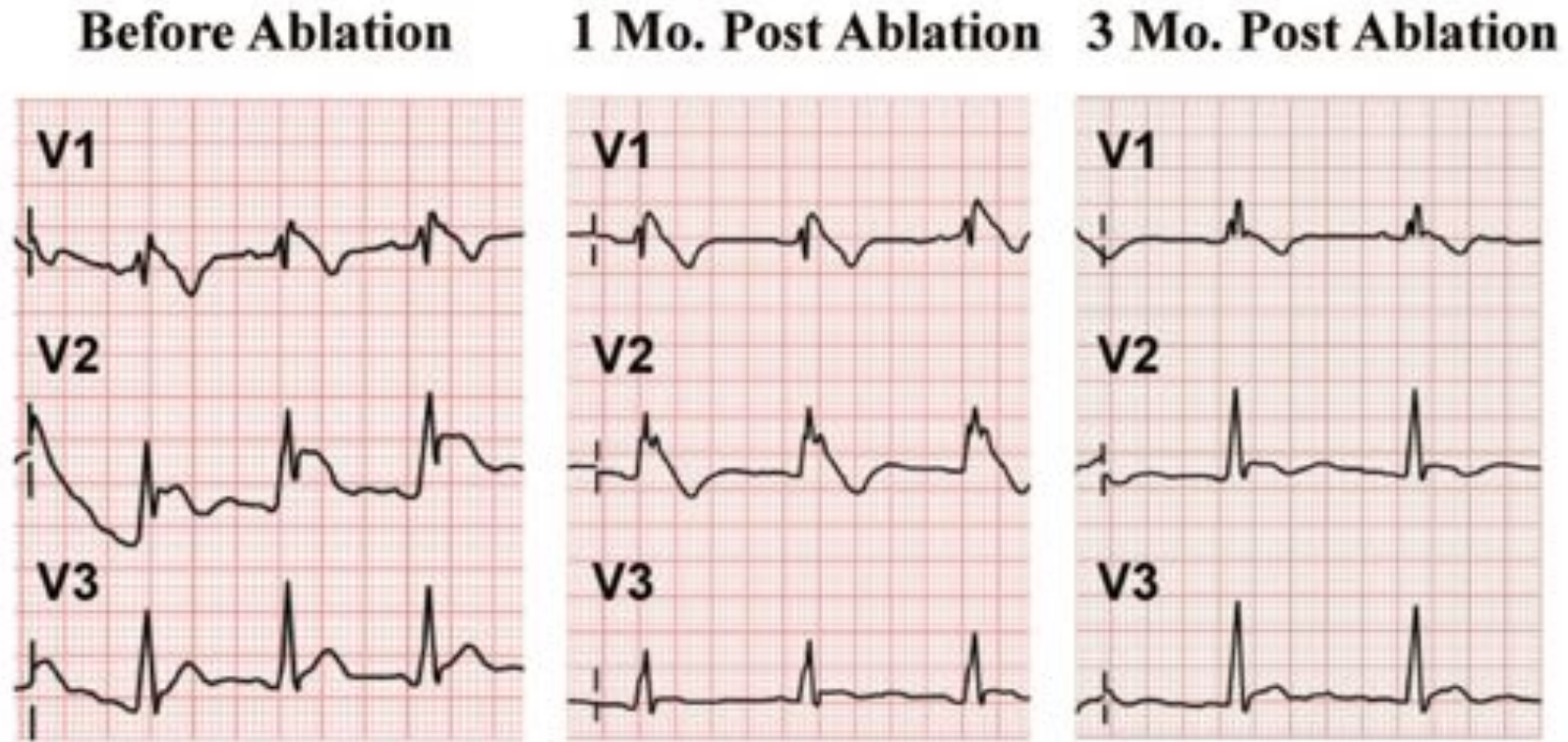


●●● ABLATION OVER THE ANTERIOR RIGHT VENTRICULAR OUTFLOW TRACT EPICARDIUM

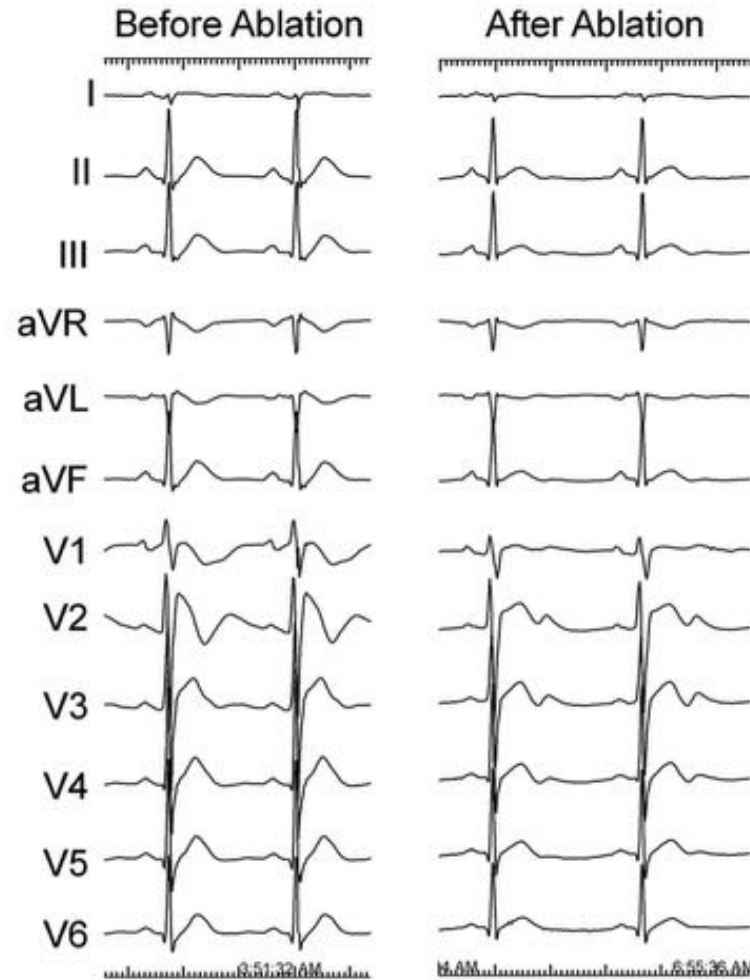


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●●● ABLATION OVER THE ANTERIOR RIGHT VENTRICULAR OUTFLOW TRACT EPICARDIUM



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## ●●● ABLATION OVER THE ANTERIOR RIGHT VENTRICULAR OUTFLOW TRACT EPICARDIUM

**Table 3. Characteristics of Electrograms Among 4 Mapping Areas**

Electrogram Characteristics	RV Epicardium (n=261)	Anterior RVOT Epicardium (n=189)	LV Epicardium (n=164)	RV Endocardium (n=213)
Bipolar, mV*	1.35±1.2	0.94±0.79	2.81±2	3±2.7
LP, ms*	32±31	96±47	6±19	13±23
Electrogram duration, ms*	76±28	132±48	60±17	66±21

Data presented as mean±SD.

\*ANOVA test:  $P < 0.001$ .

RV indicates right ventricle; RVOT, right ventricular outflow tract; LV, left ventricle; and LP, late potential.

# ●●● ABLATION OVER THE ANTERIOR RIGHT VENTRICULAR OUTFLOW TRACT EPICARDIUM

**Table 1. Clinical Characteristics of the Study Patients**

Patient	Age	Sex	BrS-ECG	VF Episodes per Month, n	Initial Symptoms	BrS ECG After, Yes/No	Inducible Before	Inducible After	Time from ICD to First Episodes, mo	Follow-Up Period, mo
1	29	M	Yes	5	CA	Yes	Single	Noninducible	4	33
2	38	M	Yes/Aj	3	CA	No	Single	Triple	23	24
3	32	M	Yes	4	CA	No	Single	Noninducible	5	20
4	24	M	Yes	4	CA	No	Double	Triple	36	20
5	52	M	Yes/Aj	6	CA	No	Double	Noninducible	83	20
6	45	M	Yes	2	CA	No	Double	Noninducible	7	17
7	35	M	Yes	5	CA	No	Double	Noninducible	12	20
8	53	M	Yes	2	CA	No	Triple	Noninducible	60	12
9	47	M	Yes	6	CA	No	Double	Noninducible	16	12
Median	38			4					16	20

Aj indicates ajmaline; BrS, Brugada syndrome; ICD, implantable cardioverter-defibrillator; CA, cardiac arrest; and VF, ventricular fibrillation.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY

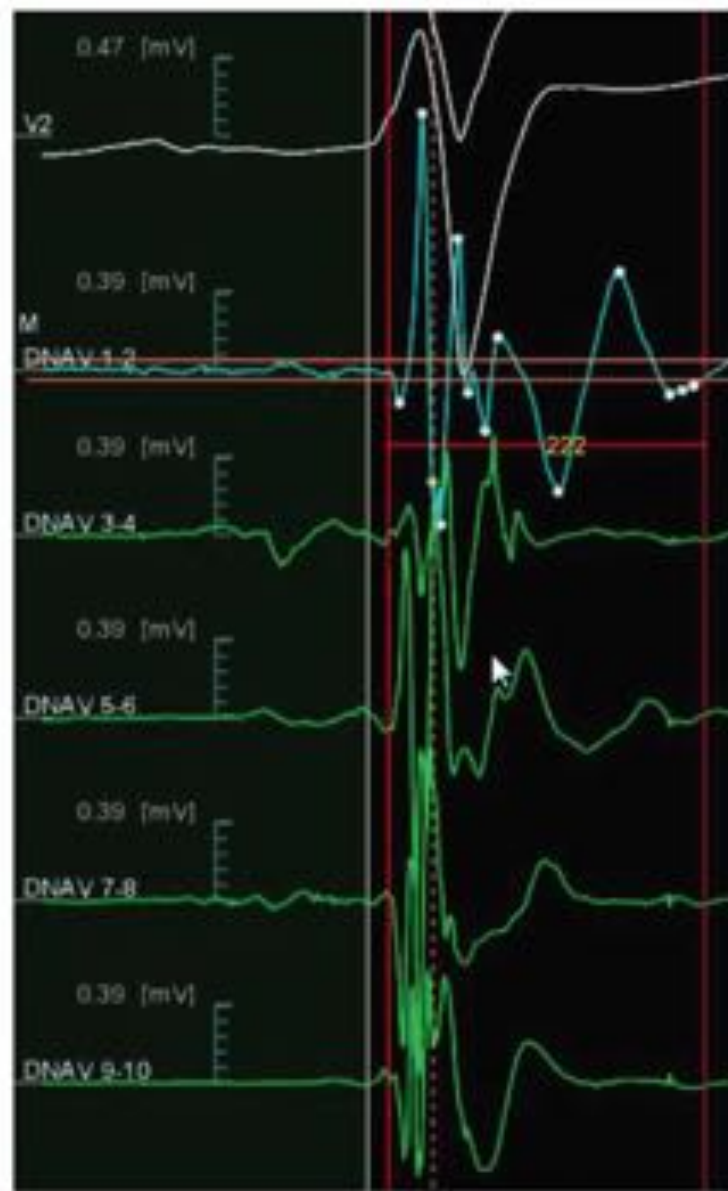
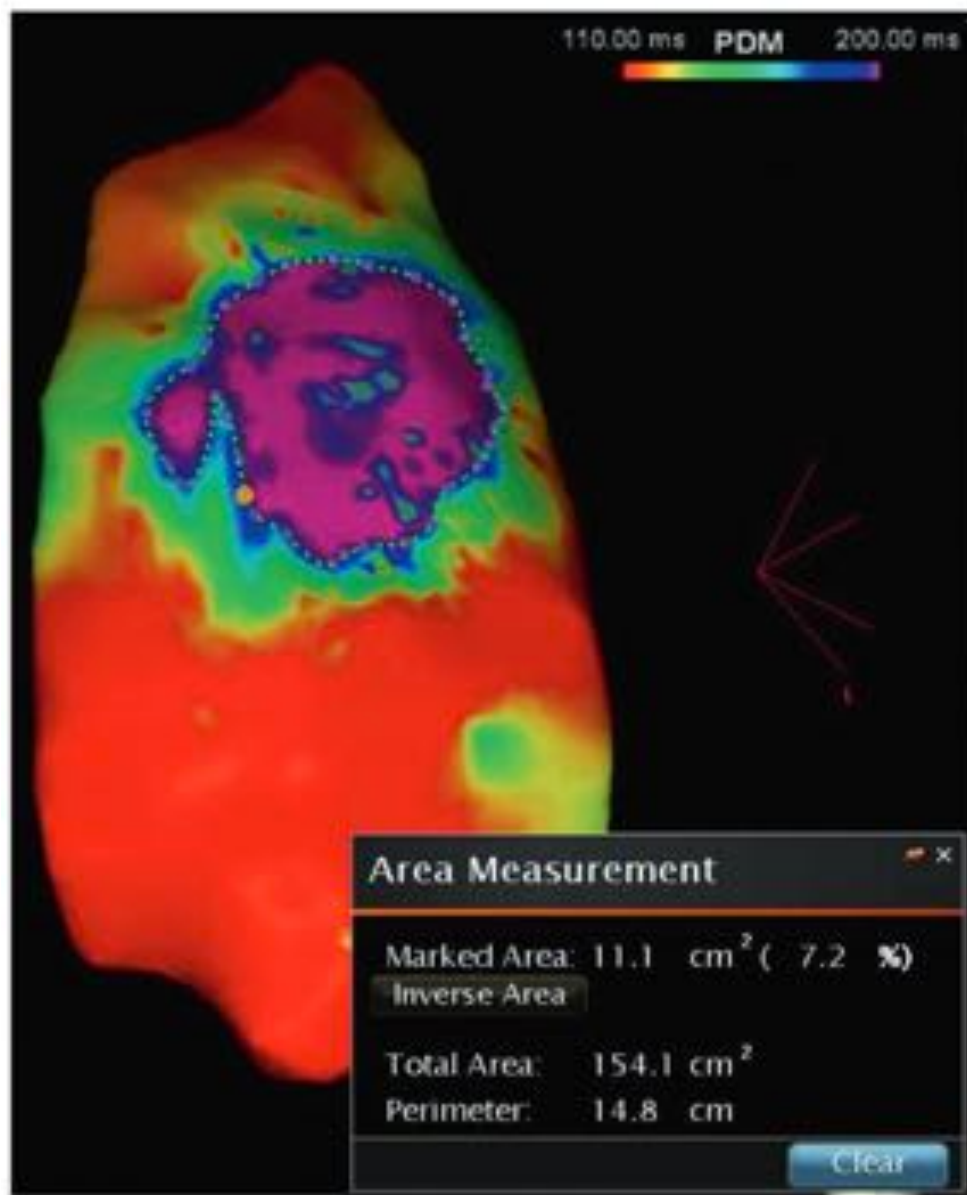
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# Assessing the Malignant Ventricular Arrhythmic Substrate in Patients With Brugada Syndrome



Carlo Pappone, MD, PhD,<sup>a</sup> Giuseppe Ciconte, MD,<sup>a</sup> Francesco Manguso, MD, PhD,<sup>a</sup> Gabriele Vicedomini, MD,<sup>a</sup> Valerio Mecarocci, MD,<sup>a</sup> Manuel Conti, MD,<sup>a</sup> Luigi Giannelli, MD,<sup>a</sup> Paolo Pozzi, BEng,<sup>a</sup> Valeria Borrelli, PhD,<sup>a</sup> Lorenzo Menicanti, MD,<sup>b</sup> Zarko Calovic, MD,<sup>a</sup> Giuseppe Della Ratta, MD,<sup>a</sup> Josep Brugada, MD, PhD,<sup>c</sup> Vincenzo Santinelli, MD<sup>d</sup>

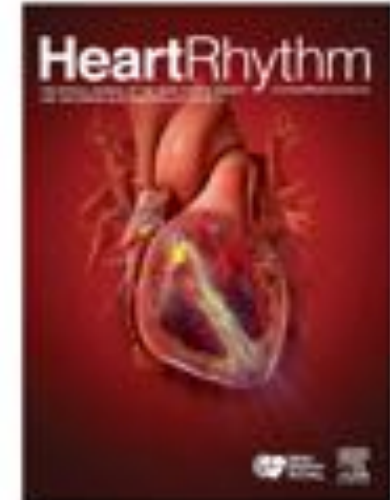


# HYBRID EPICARDIAL ABLATION

## Accepted Manuscript

Hybrid thoracoscopic epicardial ablation of right ventricular outflow tract in patients with Brugada Syndrome

Francesca Salghetti, MD, Carlo de Asmundis, MD, PhD, FHRS, Juan Sieira, MD, PhD, Hugo Enrique Coutiño, MD, PhD, Juan Pablo Abugattas, MD, Varnavas Varnavas, MD, Riccardo Maj, MD, Muryo Terasawa, MD, Thiago Guimarães Osório, MD, Erwin Stroker, MD, Lucio Capulzini, MD, Saverio Iacopino, MD, Gaetano Paparella, MD, Vincent Umbrain, MD, PhD, Jan Poelaert, MD, PhD, Sonia Van Dooren, PhD, Pedro Brugada, MD, PhD, FHRS, Gian Battista Chierchia, MD, PhD, Mark La Meir, MD PhD



# HYBRID EPICARDIAL ABLATION

Overall N Patients = 36		
Age, y ( $\pm$ SD, range)	36.6	( $\pm$ 15.8; 3-63)
Male sex, n pt (%)	26	(72.2)
Spontaneous type I, n pt (%)	3	(8.3)
Proband, n pt (%)	23	(63.8)
Aborted SCD, n pt (%)	3	(8.3)
Syncope, n pt (%)	18	(50)
Inducible EPS, n pt (%)	4	(11.1)
Family history of SCD <35 y, n pt (%)	16	(44.4)

Previous SND, n pt (%)	2	(5.5)
Previous AF, n pt (%)	6	(16.6)
Previous ICD implantation, n pt (%)	6	(16.6)
Previous documented VA, n pt (%)	7	(19.4)
Previous ICD shocks, n pt (%)	2	(5.5)
f-QRS, n pt (%)	6	(16.6)
Positive genetic test, n pt (%)	Overall	11 (30.5)
	SCN5A	7 (19.4)

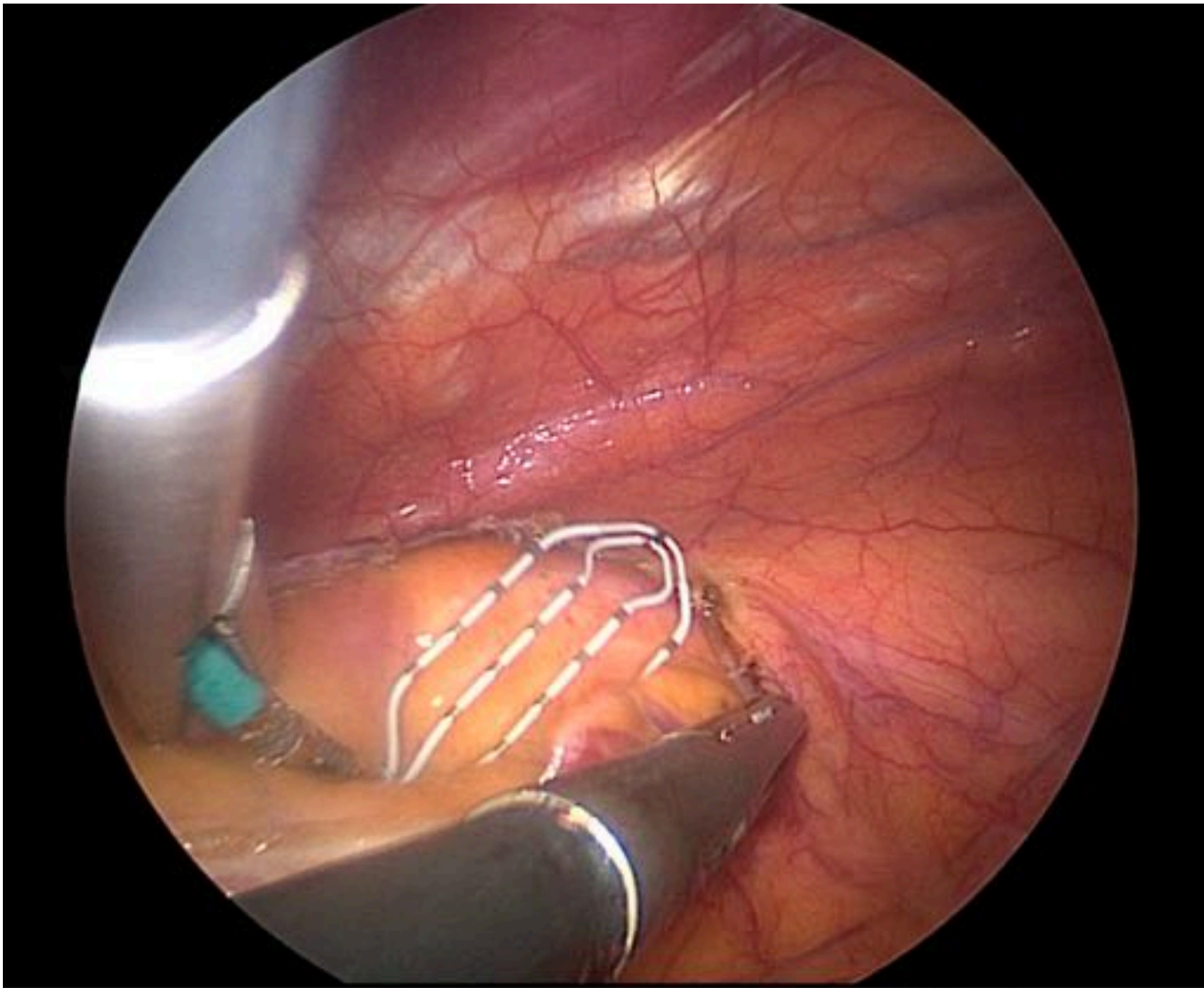
# HYBRID EPICARDIAL ABLATION

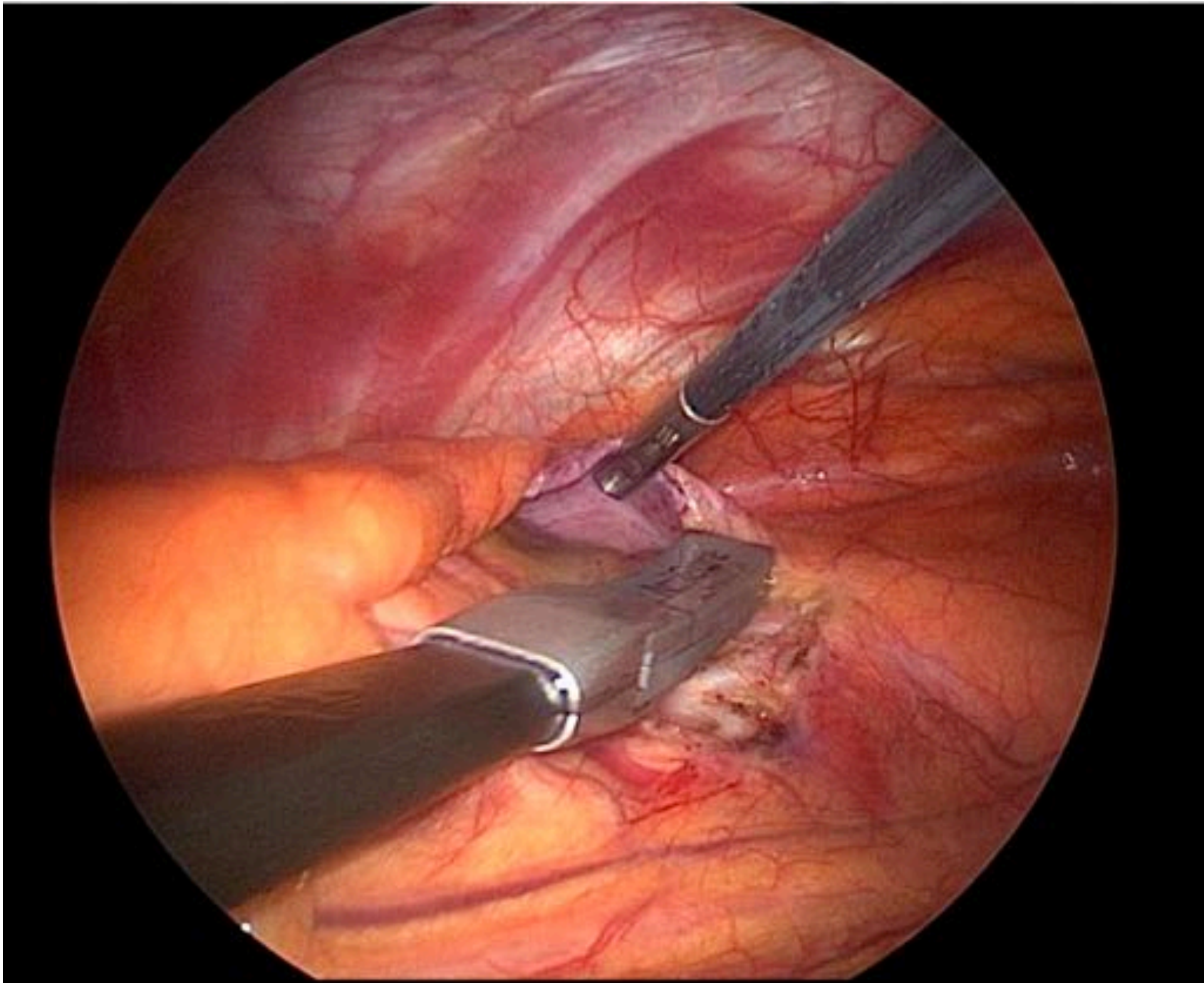
Overall N Patients = 36		
Left-thoracoscopic access, n (%)		36 (100)
Concomitant epicardial-subcostal ICD implantation, n (%)		27 (75)
Spontaneous fragmented potentials, n (%)		14 (38.8)
Ajmaline challenge induced fragmented potentials *, n (%)		33 (91.6)
Late fragmented low voltage site	Anterior RVOT, n (%)	28 (77.8)
	Extended Anterior-Lateral/Medial RVOT, n (%)	8 (22.2)
Ablation catheter	Bipolar conventional ablation catheter, n (%)	27 (75)
	Linear epicardial ablation catheter, n (%)	9 (25)
Ajmaline challenge intraoperative after ablation	Type I, n (%)	1 (2.7)
	Fragmentation, n (%)	2 (5.5)

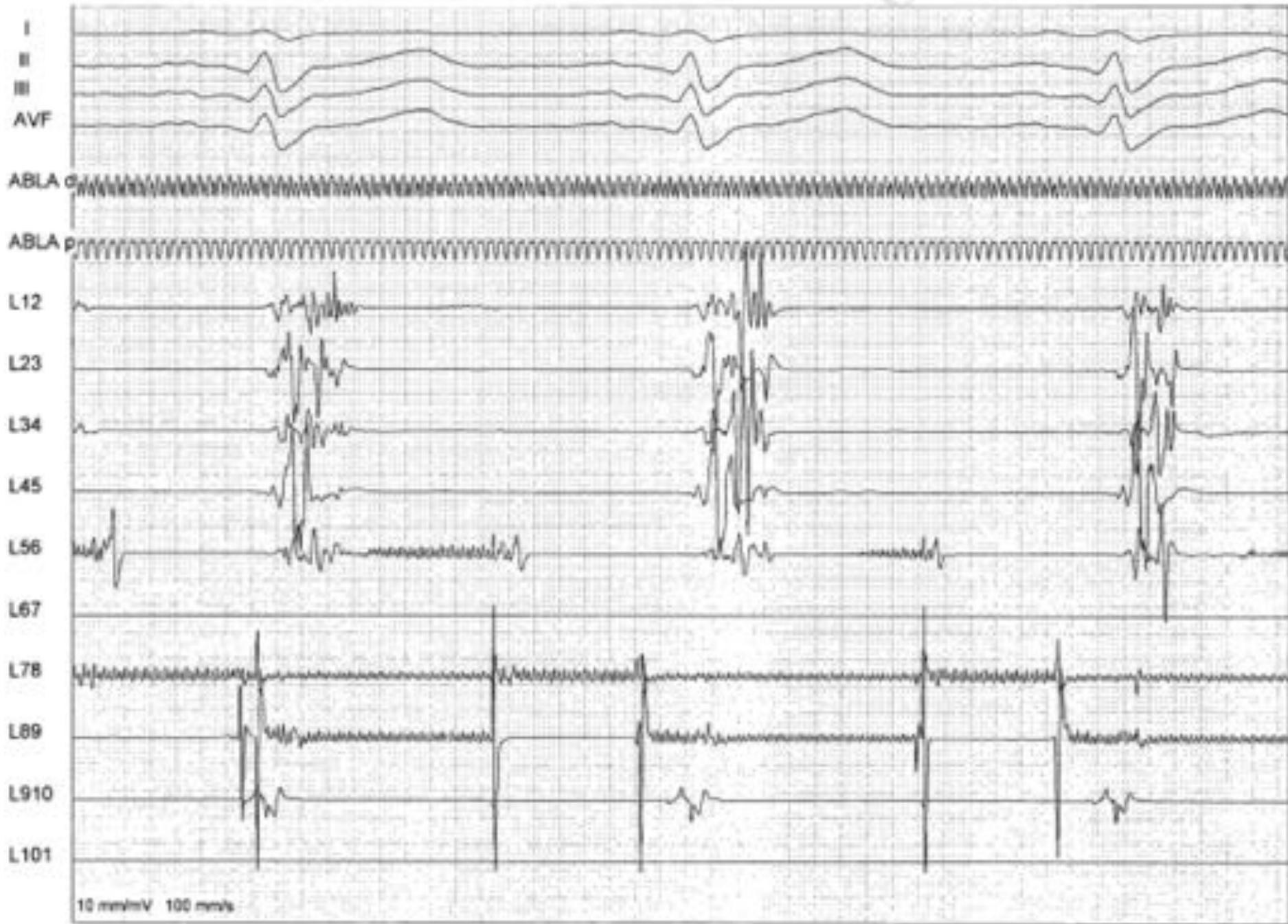
# HYBRID EPICARDIAL ABLATION

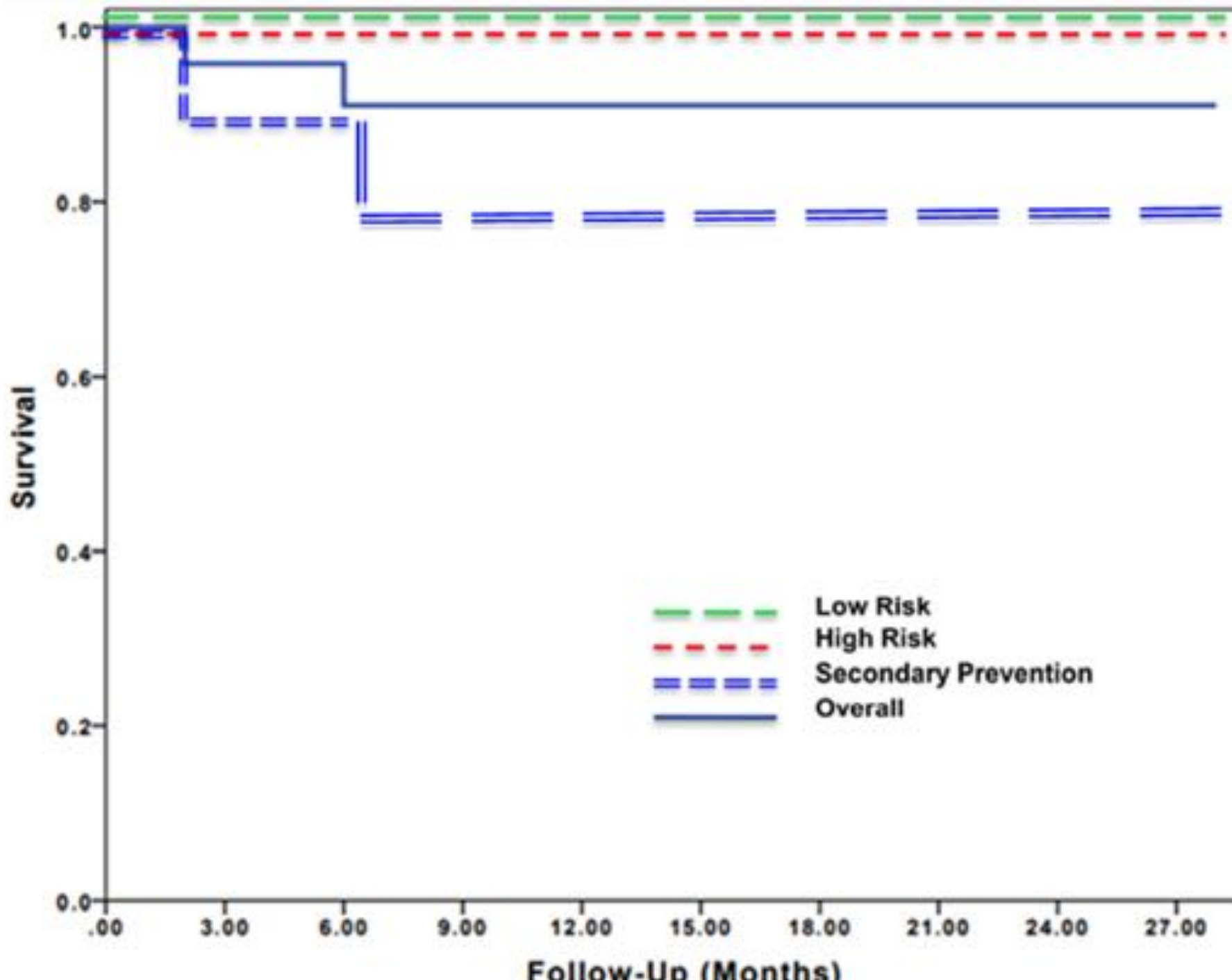
Procedure time, min ( $\pm$ SD, range)		42	( $\pm$ 3; 37-49)
Ablation time, min ( $\pm$ SD, range)		12	( $\pm$ 5; 3-19)
Hospitalization, days ( $\pm$ SD, range)		4	( $\pm$ 1.2; 2-7)
Complications n pt (%)	Intraoperative	0	(0)
	Late cardiac tamponade	1	(2.8)
	Pericarditis	9	(25)
Ajmaline-induced type I, n pt (%) 1 month		1	(2.8)
Spontaneous type I, n pt (%) 1 month		0	(0)



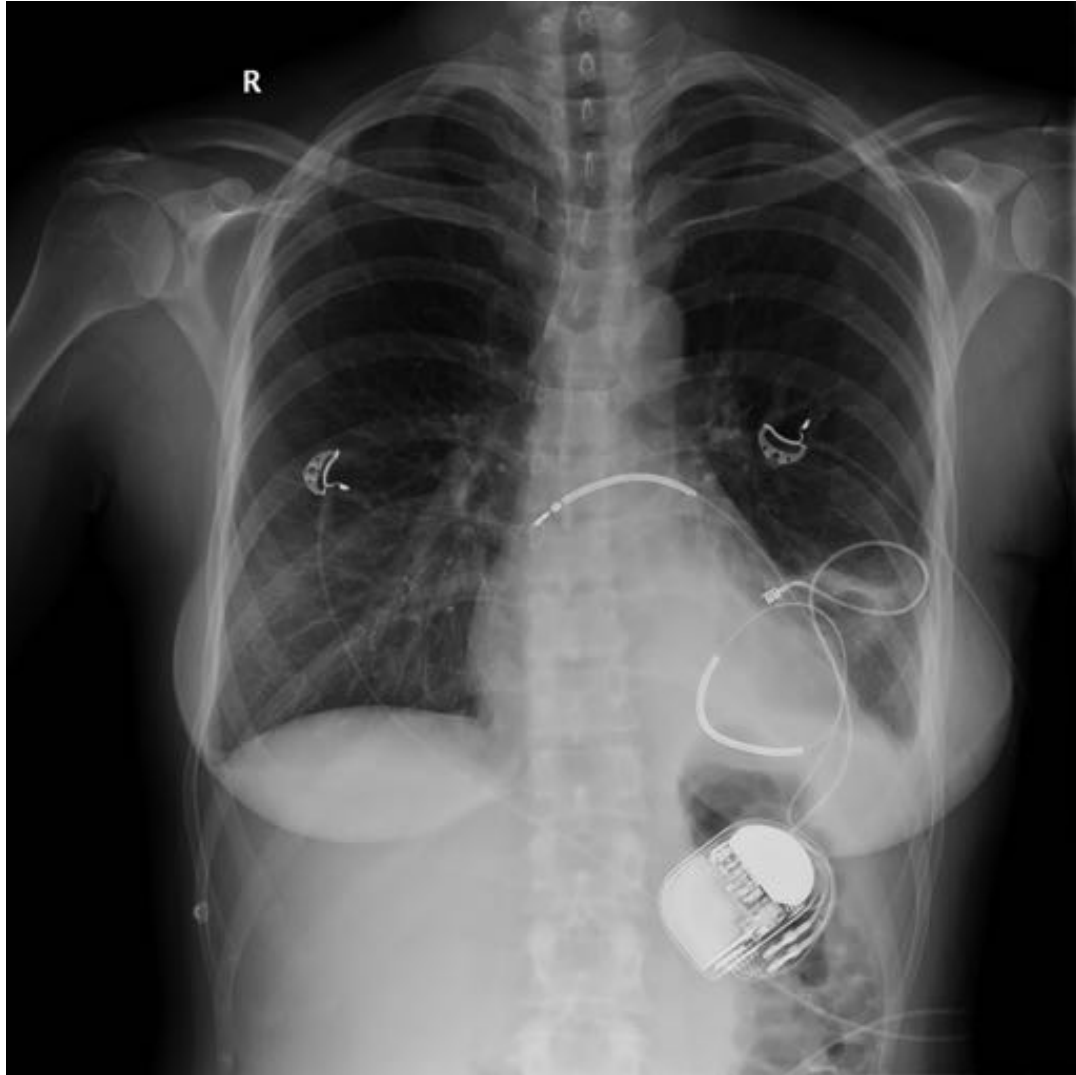








# ●●● EPICARDIAL ICD



## ●●● CONCLUSIONS

- Complex risk stratification
- Epicardial ablation offers good outcomes
- Recurrences are possible
  - Need to implant ICD

# Thank You



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