Session 3. Device Programming & Management for VT/VF

How to Manage The VT or VF Episodes During Follow Up

경희 의대 김진배

Disclosure : none

Male 61 yrs old

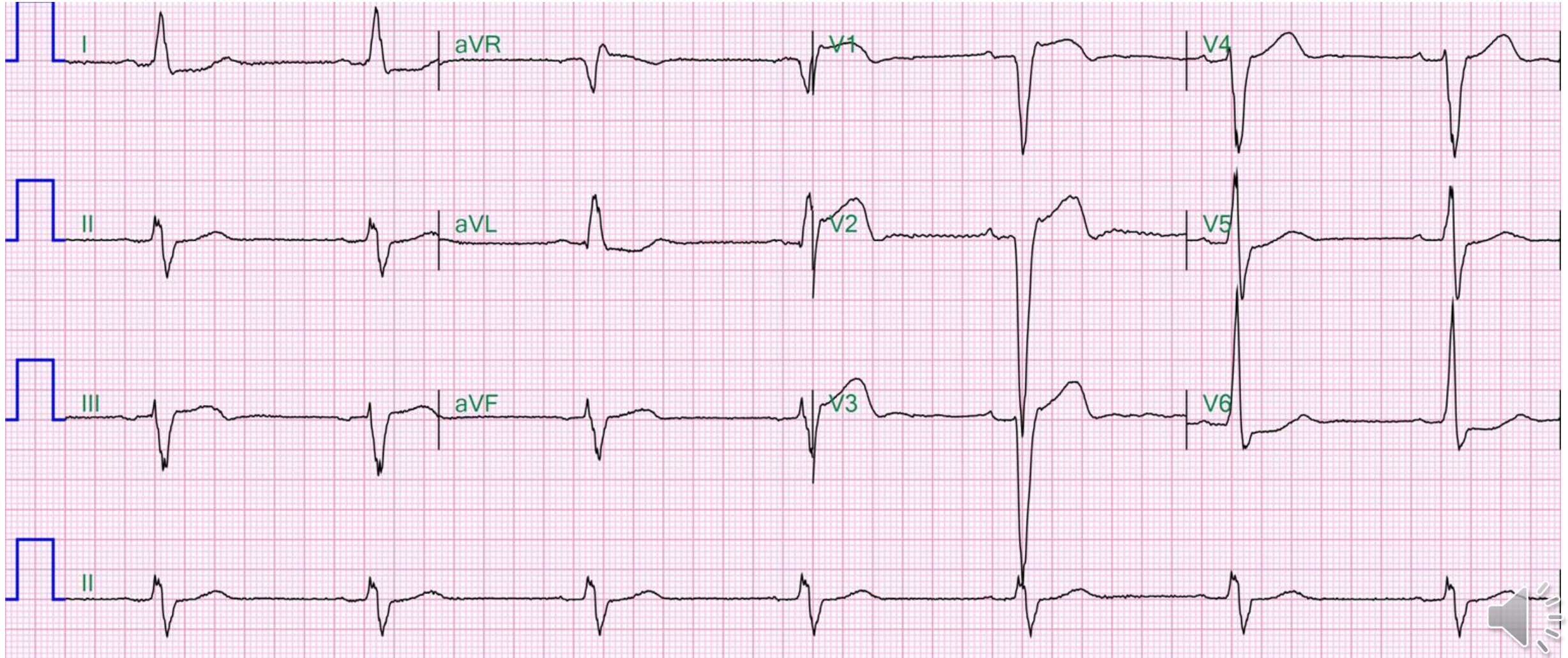' 09. DCMP진단 (EF 31%), minimal coronary

disease
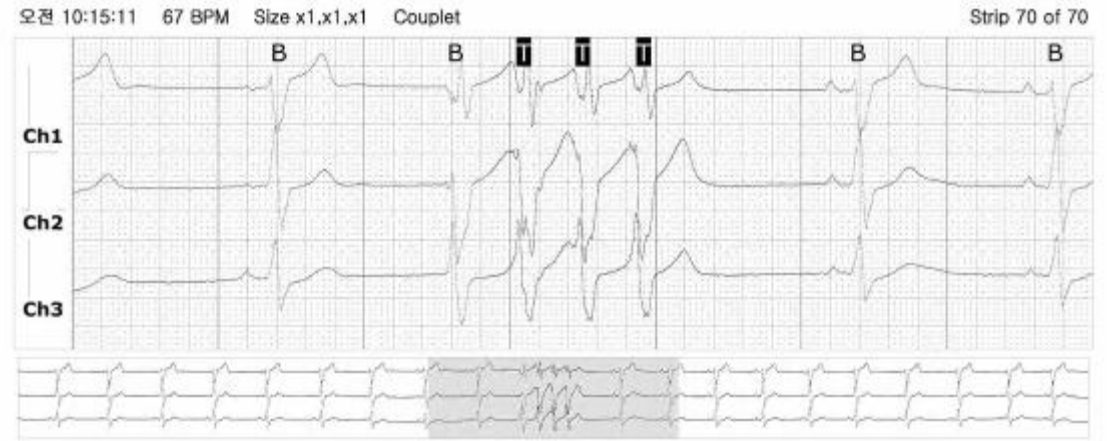
　　medical Tx
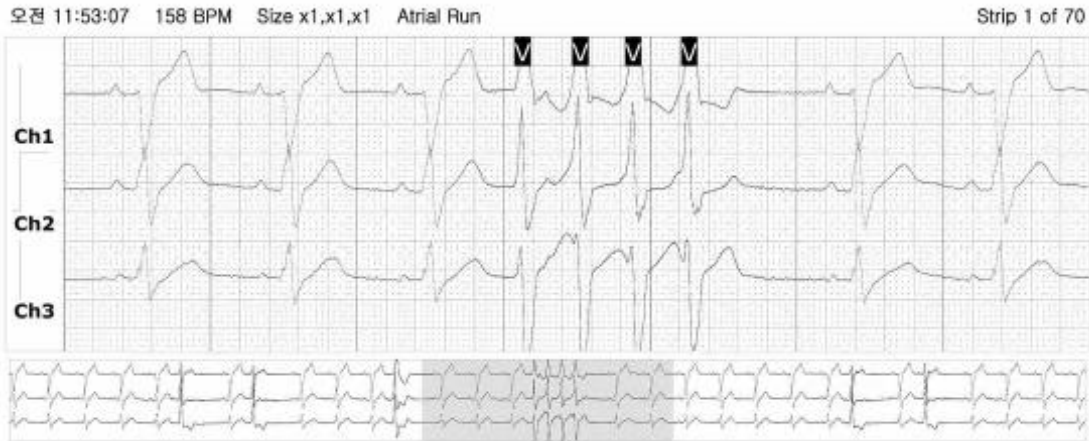
' 12. VT episode로 VT ablation시행

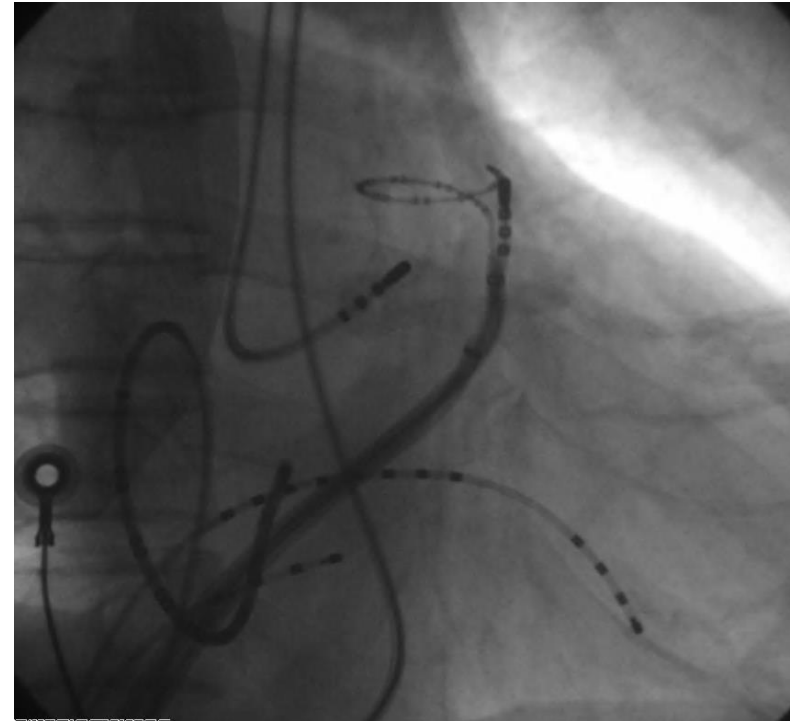' 13. recurrent VT, DCMP로 CRT-D implantation

ECG ('09)

Telemetry monitoring

Multiple episodes of nonsustained VT (1-2 secs)
PVC burden = 4.1%

EPS ('12)
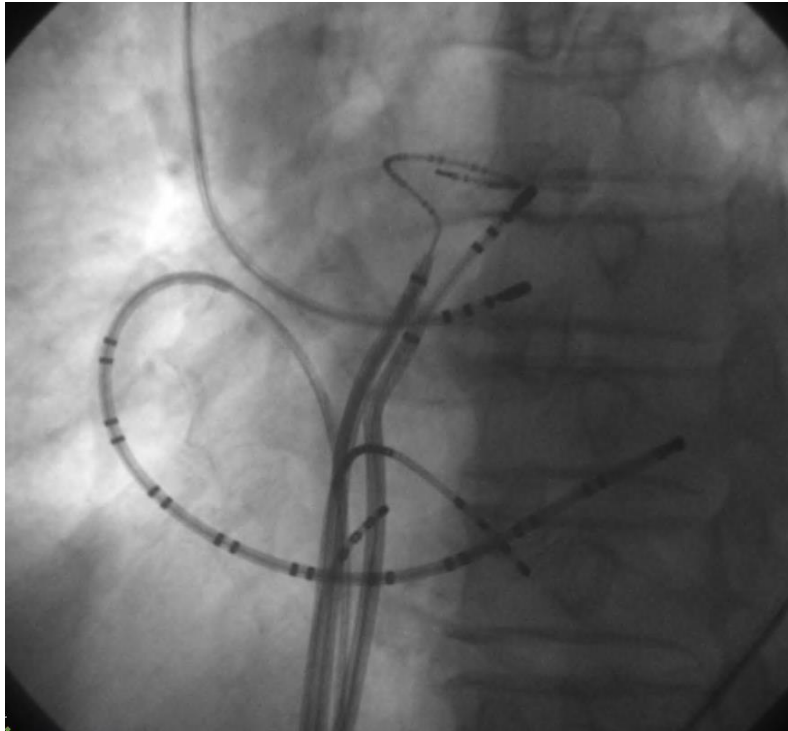
✓ VT was not reproducibly induced with PES.
✓ Failed catheter ablation of VT due to noninducibility

CRT-D implantation

Chest PA

Echocardiography

Dilated LV   (LVIDd 63mm, LVIDs
54mm,LVEDV 120ml , LVESV 88ml)
Moderate to severe systolic dysfunction (EF:
30% by simpson's method, M mode 25%)
Global hypokinesia
Valve : Fibrothickened AV and MV
Mild AR, TR, MR
Diastolic function: Restrictive pattern (E/E' 33)

Drug therapy for VT

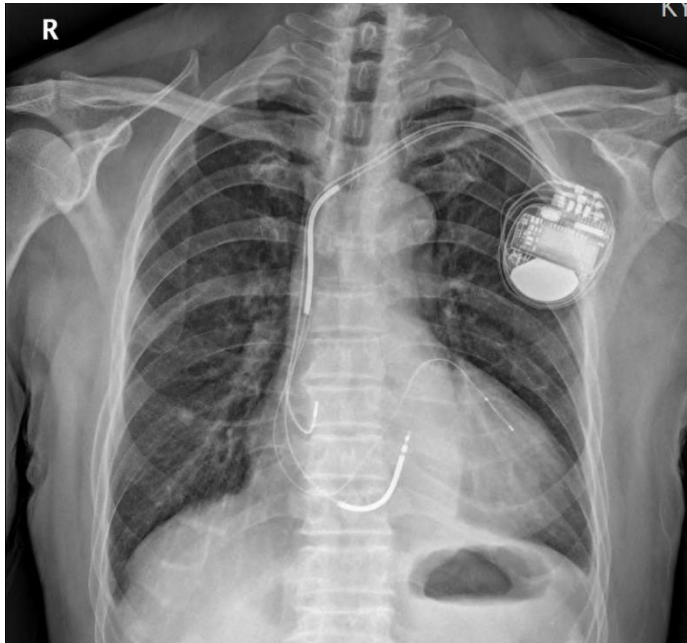✓ The only drugs that have shown a reduction in VT episodes, in randomized clinical trials (RCTs), are amiodarone and sotalol.

✓ RCTs have demonstrated that these drugs can reduce VT recurrences in patients with an ICD; however, their efficacy is moderate, with no benefit on overall mortality and significant side effects

Comparison of β-Blockers, Amiodarone Plus β-Blockers, or Sotalol for prevention of shocks from implantable cardioverter defibrillators: the OPTIC Study: A Randomized Trial. JAMA. 2006
Amiodarone for the prevention of sudden cardiac death: a meta-analysis of randomized controlled trials. Eur Heart J. 2009
Effect of d-sotalol on mortality in patients with left ventricular dysfunction after recent and remote myocardial infarction. The SWORD investigators. Survival With Oral d-Sotalol. Lancet. 1996

Prophylactic catheter ablation ?

ORIGINAL RESEARCH ARTICLE

Preventive or Deferred Ablation of Ventricular Tachycardia in Patients With Ischemic Cardiomyopathy and Implantable Defibrillator (BERLIN VT)

A Multicenter Randomized Trial

Defered ablation ➜ after 3rd appropriated shock

Circulation 2020

A Primary Endpoint
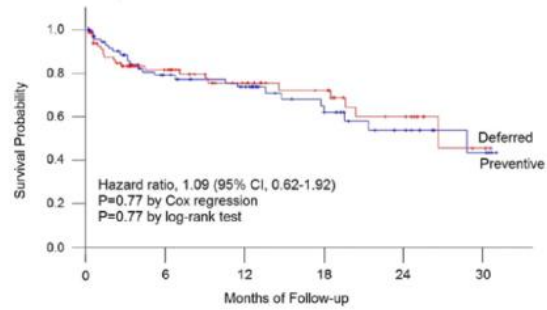
B Death from any Cause
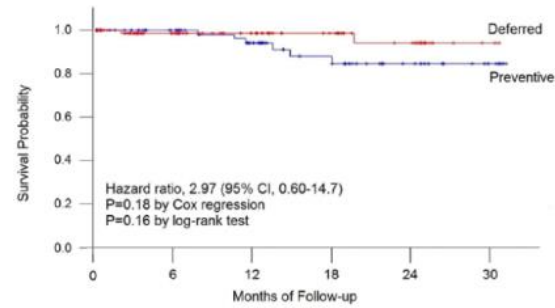
C Hospitalization for Worsening Heart Failure
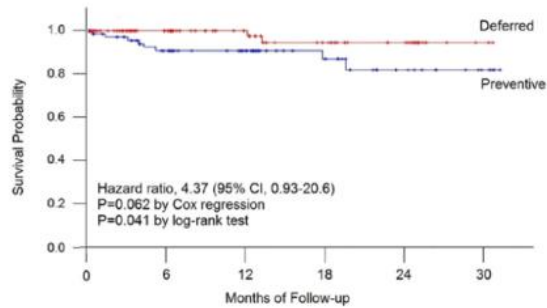
D Hospitalization for Ventricular Arrhythmia (VT/VF)
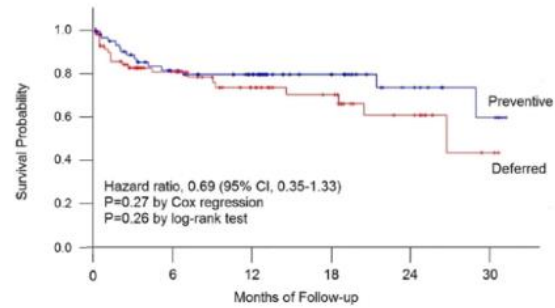
Preventive VT ablation before ICD implantation **did not reduce** mortality or hospitalization for arrhythmia or worsening heart failure during a 1-year of follow-up

2019 HRS/EHRA/APHRS/LAHRS expert consensus statement on catheter ablation of ventricular arrhythmias

Recommendations	COR	LOE
In patients with NICM and recurrent sustained monomorphic VT for whom antiarrhythmic medications are ineffective, contraindicated, or not tolerated, catheter ablation is useful for reducing recurrent VT and ICD shocks.	I	B-NR
In patients with NICM and electrical storm refractory to AAD therapy, catheter ablation is useful for reducing recurrent VT and ICD shocks.	IIa	B
In patients with IHD and an ICD who experience a first episode of monomorphic VT, catheter ablation may be considered to reduce the risk of recurrent VT or ICD therapies.	IIb	A

Real world practice
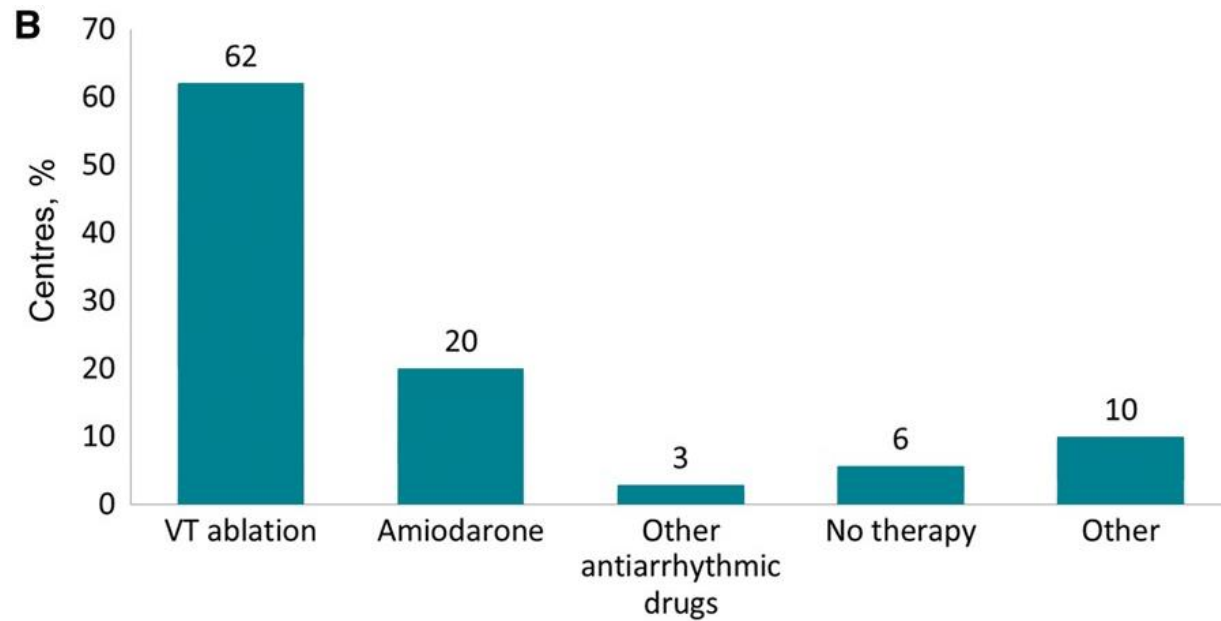
Ischemic CMP
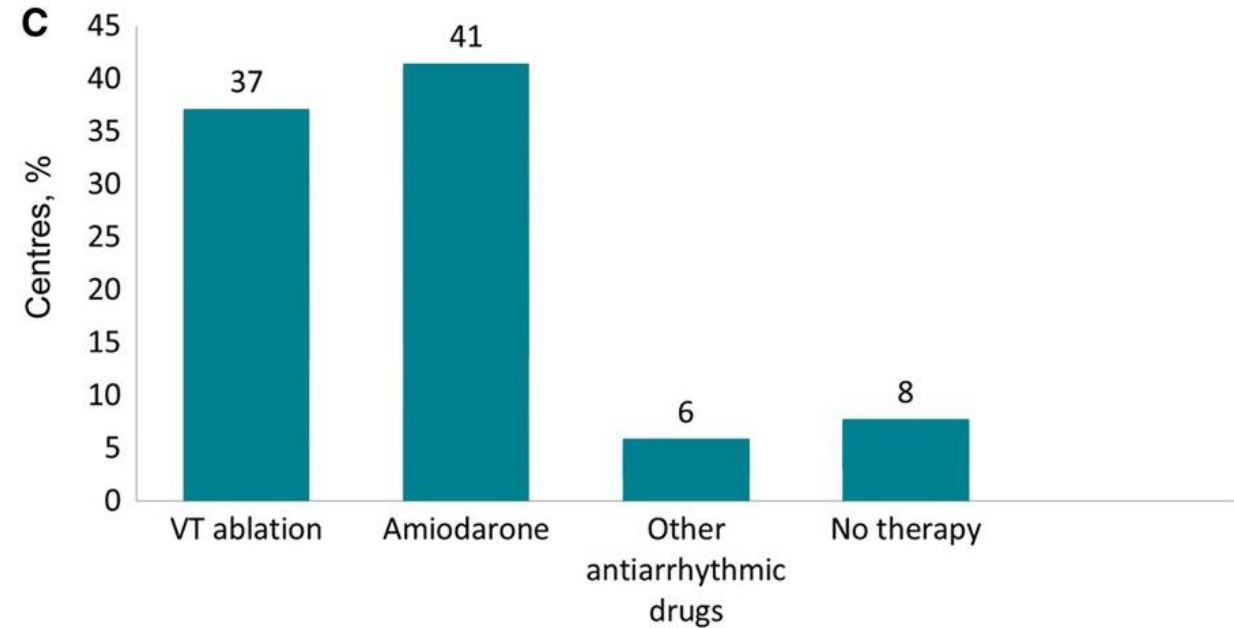
Nonischemic CMP

Tilz RR, et al. Management of ventricular tachycardia in the ablation era: the EHRA Survey. Europace. 2018

Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs

John L. Sapp, M.D., George A. Wells, Ph.D., Ratika Parkash, M.D., William G. Stevenson, M.D.,
Louis Blier, M.D., Jean-Francois Sarrazin, M.D., Bernard Thibault, M.D., Lena Rivard, M.D.,
Lorne Gula, M.D., Peter Leong-Sit, M.D., Vidal Essebag, M.D., Ph.D., Pablo B. Nery, M.D., Stanley K. Tung, M.D.,
Jean-Marc Raymond, M.D., Laurence D. Sterns, M.D., George D. Veenhuyzen, M.D., Jeff S. Healey, M.D.,
Damian Redfearn, M.D., Jean-Francois Roux, M.D., and Anthony S.L. Tang, M.D.

VANISH Clinical Trial

Patients were eligible for inclusion if
had a **myocardial infarction**,
had undergone **placement of an ICD**, and
had an episode of ventricular tachycardia **during treatment with amiodarone
or another class I or class III AAD within the previous 6 months**.

Table 2. Trial Outcomes.*

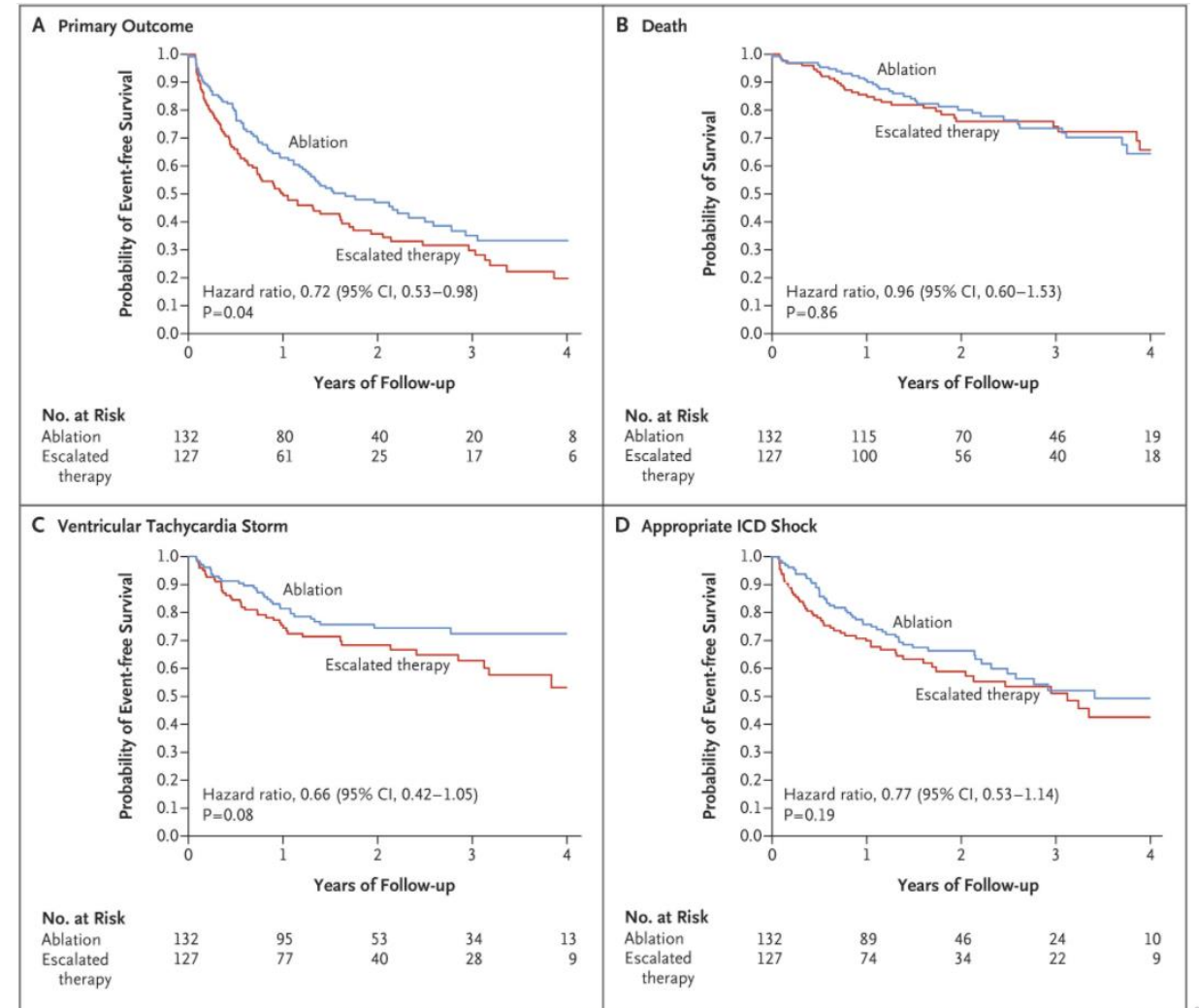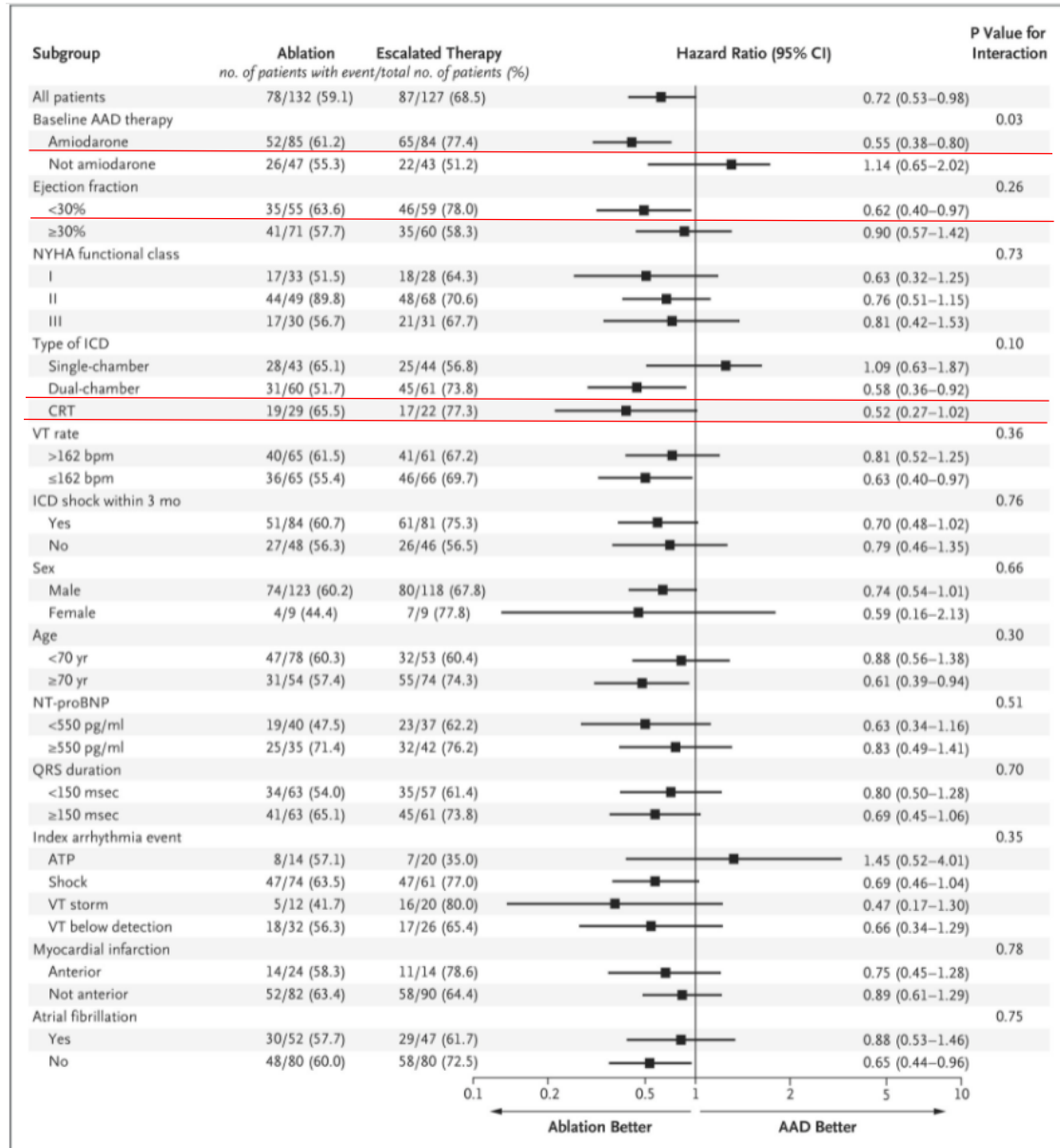| Outcome	Escalated Therapy (N=127)	Catheter Ablation (N=132)	Hazard Ratio (95% CI)	P Value
	no. (%)			
Primary outcome†	87 (68.5)	78 (59.1)	0.72 (0.53–0.98)	0.04
Death	35 (27.6)	36 (27.3)	0.96 (0.60–1.53)	0.86
From cardiovascular causes‡	26	24		
From noncardiovascular causes	8	12		
From unknown cause	1	0		
Appropriate ICD shock after 30 days	54 (42.5)	50 (37.9)	0.77 (0.53–1.14)	0.19
Ventricular tachycardia storm after 30 days	42 (33.1)	32 (24.2)	0.66 (0.42–1.05)	0.08
Other outcomes				
Appropriate ICD shock at any time	54 (42.5)	56 (42.4)	0.97 (0.66–1.40)	0.85
Ventricular tachycardia storm at any time	46 (36.2)	38 (28.8)	0.74 (0.48–1.14)	0.17
Sustained ventricular tachycardia below ICD detection limit				
At any time	13 (10.2)	4 (3.0)	0.27 (0.09–0.84)	0.02
After 30 days	8 (6.3)	3 (2.3)	0.33 (0.09–1.25)	0.09
Cardioversion for ventricular tachycardia§	14 (11.0)	8 (6.1)	0.52 (0.22–1.23)	0.13
Appropriate ATP				
At any time	79 (62.2)	84 (63.6)	0.97 (0.71–1.32)	0.83
After 30 days	78 (61.4)	77 (58.3)	0.87 (0.63–1.19)	0.37
Inappropriate ICD shock				
At any time	11 (8.7)	13 (9.8)	1.08 (0.48–2.41)	0.86
After 30 days	11 (8.7)	13 (9.8)	1.08 (0.48–2.42)	0.85
Hospital admission for cardiac causes	39 (30.7)	33 (25.0)	0.76 (0.48–1.21)	0.25
	no. (mean no./person-yr)			
Total shocks or arrhythmia events¶				
ICD shock				
Appropriate	266 (2.09)	169 (1.28)	NA	0.28
Inappropriate	85 (0.67)	66 (0.50)	NA	0.46
Appropriate ATP	2453 (19.2)	1711 (13.0)	NA	0.27
Sustained ventricular tachycardia below ICD detection	18 (0.14)	4 (0.03)	NA	0.02

Subgroup	Ablation	Escalated Therapy	Hazard Ratio (95% CI)	P Value for Interaction
	no. of patients with event/total no. of patients (%)			
All patients	78/132 (59.1)	87/127 (68.5)	0.72 (0.53–0.98)	
Baseline AAD therapy				0.03
Amiodarone	52/85 (61.2)	65/84 (77.4)	0.55 (0.38–0.80)	
Not amiodarone	26/47 (55.3)	22/43 (51.2)	1.14 (0.65–2.02)	
Ejection fraction				0.26
<30%	35/55 (63.6)	46/59 (78.0)	0.62 (0.40–0.97)	
≥30%	41/71 (57.7)	35/60 (58.3)	0.90 (0.57–1.42)	
NYHA functional class				0.73
I	17/33 (51.5)	18/28 (64.3)	0.63 (0.32–1.25)	
II	44/49 (89.8)	48/68 (70.6)	0.76 (0.51–1.15)	
III	17/30 (56.7)	21/31 (67.7)	0.81 (0.42–1.53)	
Type of ICD				0.10
Single-chamber	28/43 (65.1)	25/44 (56.8)	1.09 (0.63–1.87)	
Dual-chamber	31/60 (51.7)	45/61 (73.8)	0.58 (0.36–0.92)	
CRT	19/29 (65.5)	17/22 (77.3)	0.52 (0.27–1.02)	
VT rate				0.36
>162 bpm	40/65 (61.5)	41/61 (67.2)	0.81 (0.52–1.25)	
≤162 bpm	36/65 (55.4)	46/66 (69.7)	0.63 (0.40–0.97)	
ICD shock within 3 mo				0.76
Yes	51/84 (60.7)	61/81 (75.3)	0.70 (0.48–1.02)	
No	27/48 (56.3)	26/46 (56.5)	0.79 (0.46–1.35)	
Sex				0.66
Male	74/123 (60.2)	80/118 (67.8)	0.74 (0.54–1.01)	
Female	4/9 (44.4)	7/9 (77.8)	0.59 (0.16–2.13)	
Age				0.30
<70 yr	47/78 (60.3)	32/53 (60.4)	0.88 (0.56–1.38)	
≥70 yr	31/54 (57.4)	55/74 (74.3)	0.61 (0.39–0.94)	
NT-proBNP				0.51
<550 pg/ml	19/40 (47.5)	23/37 (62.2)	0.63 (0.34–1.16)	
≥550 pg/ml	25/35 (71.4)	32/42 (76.2)	0.83 (0.49–1.41)	
QRS duration				0.70
<150 msec	34/63 (54.0)	35/57 (61.4)	0.80 (0.50–1.28)	
≥150 msec	41/63 (65.1)	45/61 (73.8)	0.69 (0.45–1.06)	
Index arrhythmia event				0.35
ATP	8/14 (57.1)	7/20 (35.0)	1.45 (0.52–4.01)	
Shock	47/74 (63.5)	47/61 (77.0)	0.69 (0.46–1.04)	
VT storm	5/12 (41.7)	16/20 (80.0)	0.47 (0.17–1.30)	
VT below detection	18/32 (56.3)	17/26 (65.4)	0.66 (0.34–1.29)	
Myocardial infarction				0.78
Anterior	14/24 (58.3)	11/14 (78.6)	0.75 (0.45–1.28)	
Not anterior	52/82 (63.4)	58/90 (64.4)	0.89 (0.61–1.29)	
Atrial fibrillation				0.75
Yes	30/52 (57.7)	29/47 (61.7)	0.88 (0.53–1.46)	
No	48/80 (60.0)	58/80 (72.5)	0.65 (0.44–0.96)	

Ablation Better   AAD Better

✓**Ablation group.**
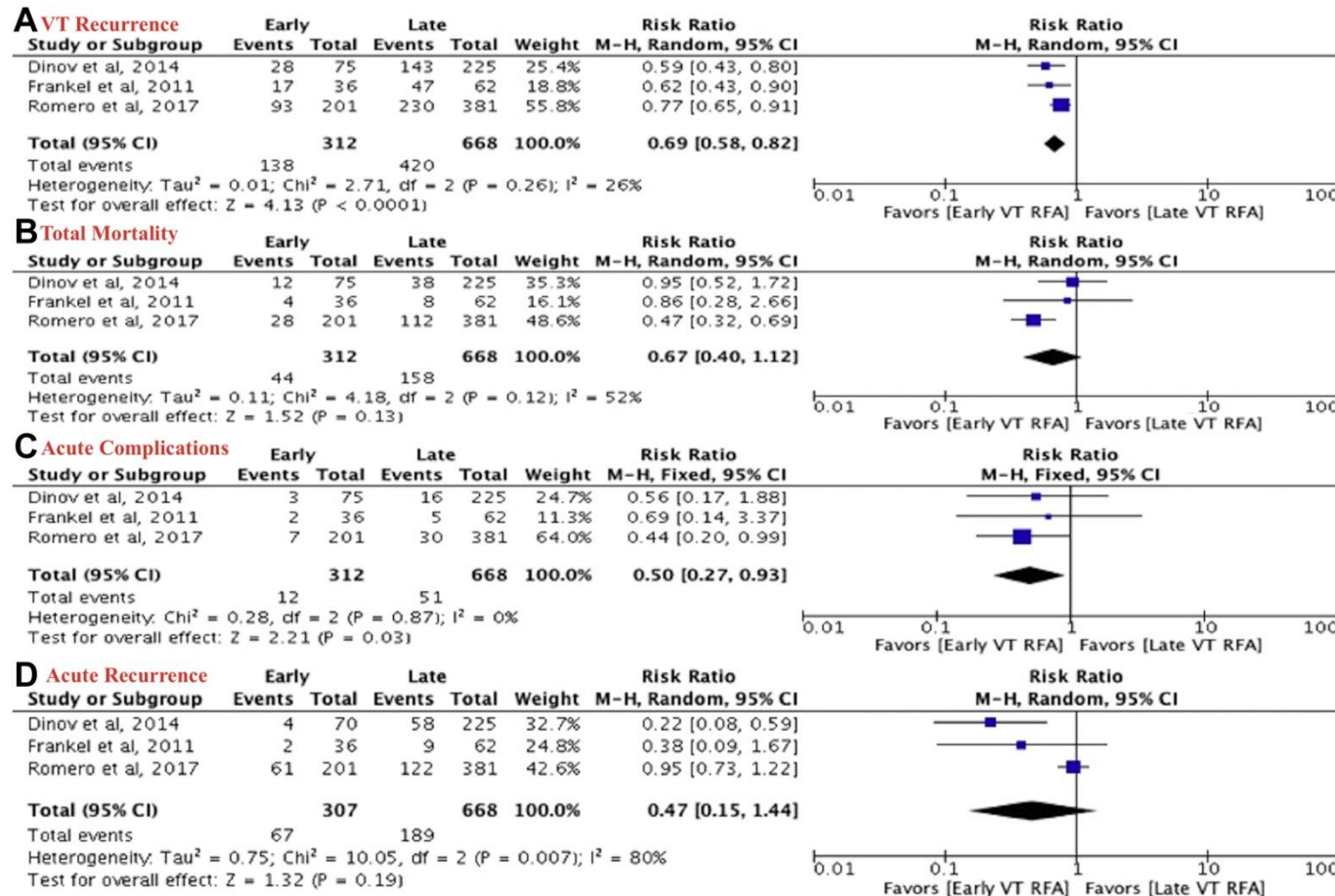2 cardiac perforations
3 major bleeding

✓**Escalated-therapy group.**
2 deaths from pulmonary toxic effects
1 from hepatic dysfunction

Early Versus Late Referral for Catheter Ablation of VT in Structural Heart Disease

Arrhythmia Episode List: 22-Jan-2020 08:47:10 to 21-Apr-2020 11:21:39
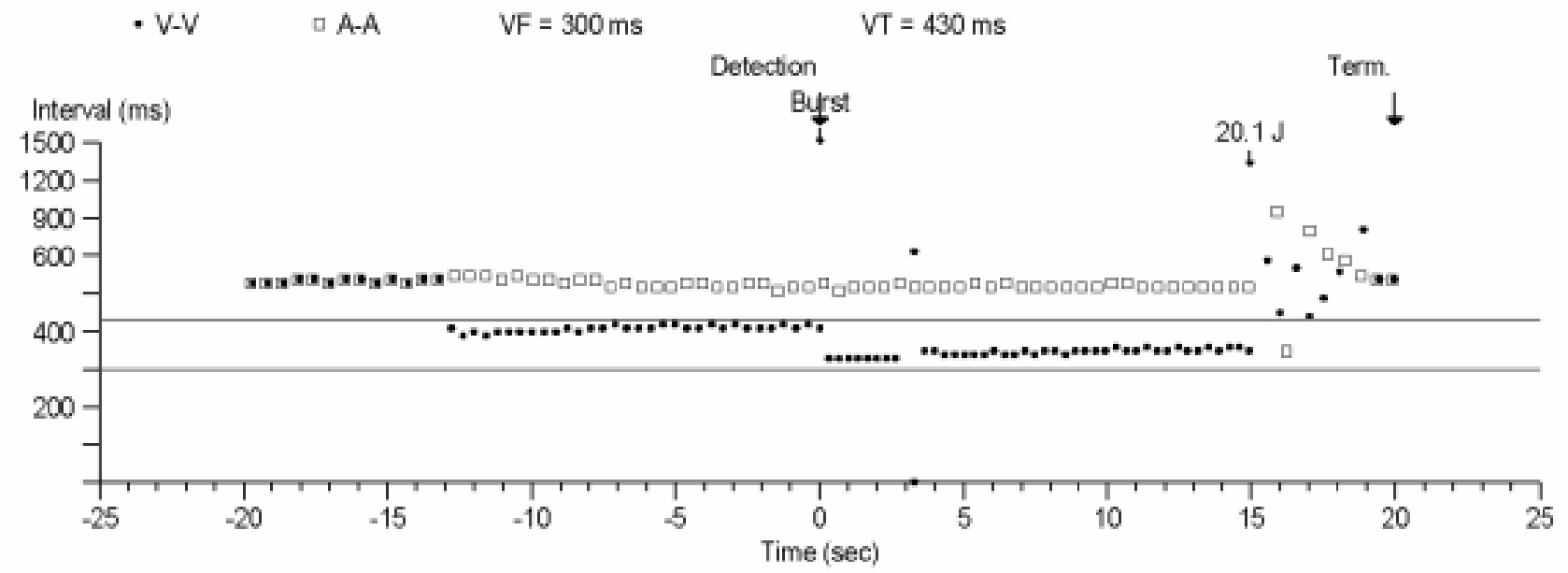All collected episodes.

Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm A/V	Max bpm A/V	Activity at Onset
VT	1	20J	Yes	296	19-Apr-2020	15:42	:28	115/146	—/176	Active
VT	1		Yes	295	19-Apr-2020	15:41	:14	113/171	—/171	Active
VT-NS				294	08-Apr-2020	22:48	:01	72/156		Rest
VT-NS				293	08-Apr-2020	22:38	:02	73/155		Rest
VT-NS				292	08-Apr-2020	22:35	:01	74/156		Rest
VT-NS				291	08-Apr-2020	22:29	:02	72/153		Rest
VT-NS				290	08-Apr-2020	22:28	:01	71/154		Rest
VT-NS				289	08-Apr-2020	22:16	:02	73/151		Rest
VT-NS				288	08-Apr-2020	22:12	:01	74/152		Rest
VT-NS				287	08-Apr-2020	22:10	:01	75/154		Rest
VT-NS				286	08-Apr-2020	22:10	:01	78/154		Rest
VT-NS				285	08-Apr-2020	22:07	:01	77/150		Rest
VT-NS				284	08-Apr-2020	22:06	:01	76/154		Rest
VT-NS				283	08-Apr-2020	21:56	:01	76/150		Rest
VT-NS				282	06-Apr-2020	20:55	:02	76/157		Rest
VT-NS				281	06-Apr-2020	20:53	:01	78/158		Rest
VT-NS				280	06-Apr-2020	20:52	:01	78/154		Rest

———————— Last Programmer Session 22-Jan-2020 ————————————————————————————————

(Data prior to last session has not been interrogated.)

Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm A/V	Max bpm A/V	Activity at Onset
VT	1	20J	Yes	296	19-Apr-2020	15:42	:28	115/146	—/176	Active

• V-V   □ A-A   VF = 300 ms   VT = 430 ms

Detection

Burst

Term.

20.1 J

Interval (ms)

VT detect ➔ ATP ➔ DC shock
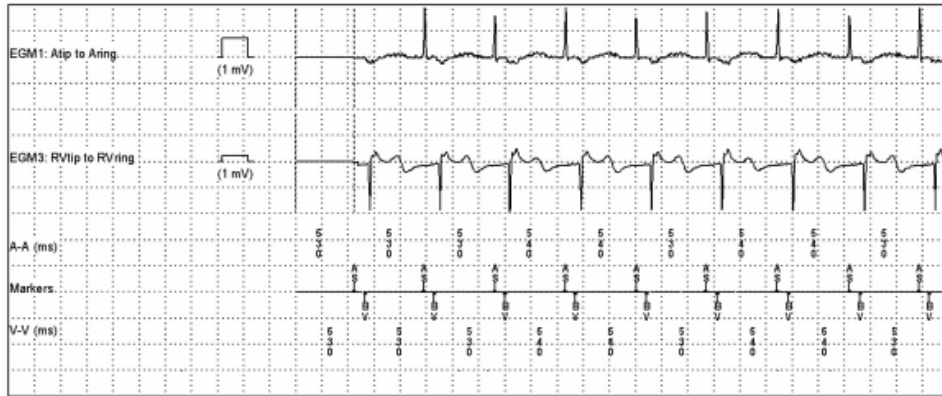
EPS ('20)
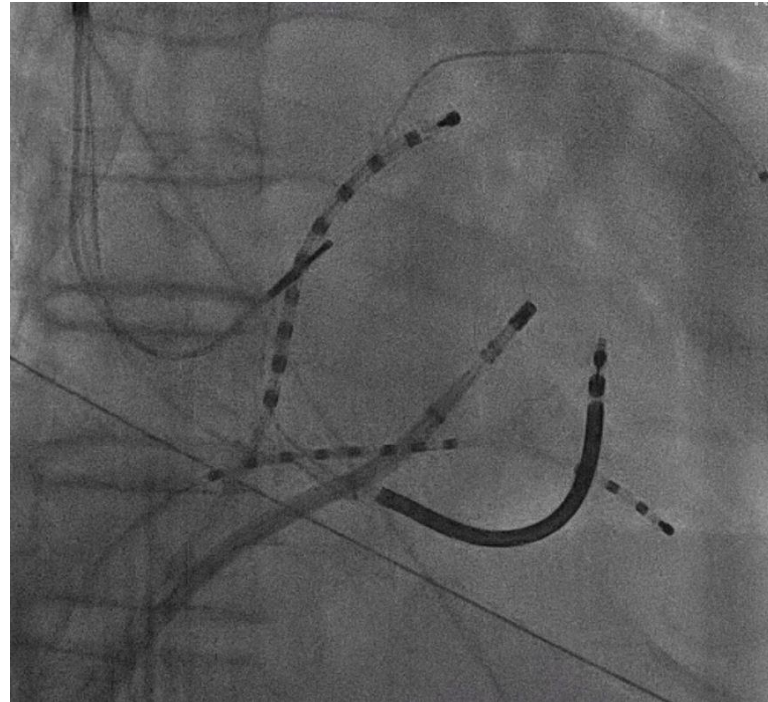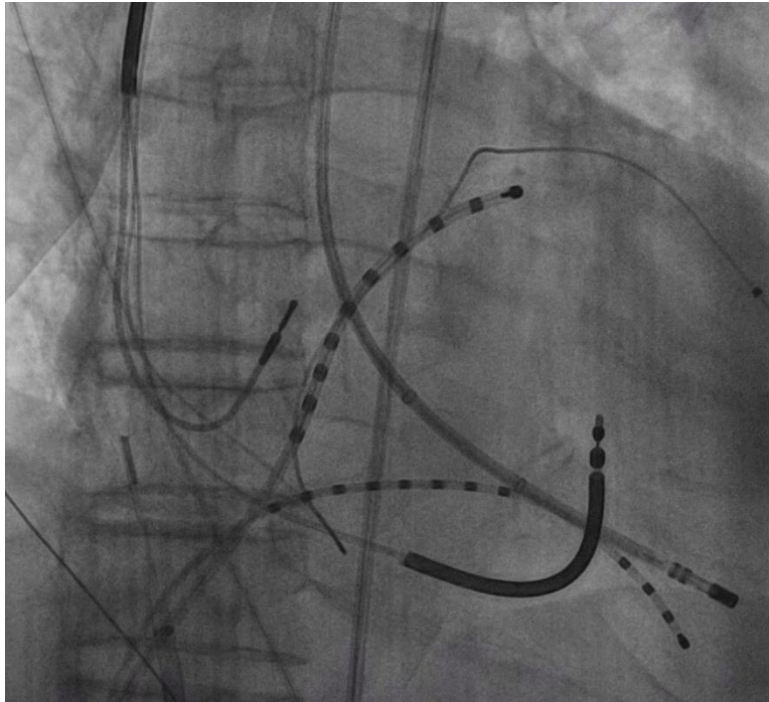
✓ 4 different VT's were induced.

✓ Some were terminated with catheter ablation, some were changed.

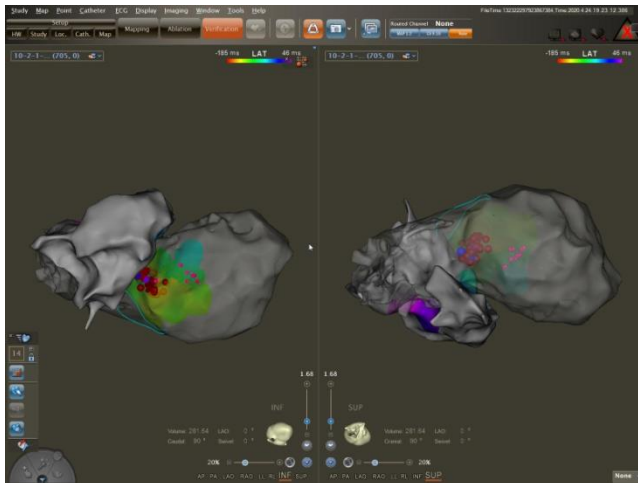# VT's and 3D mapping

VT1
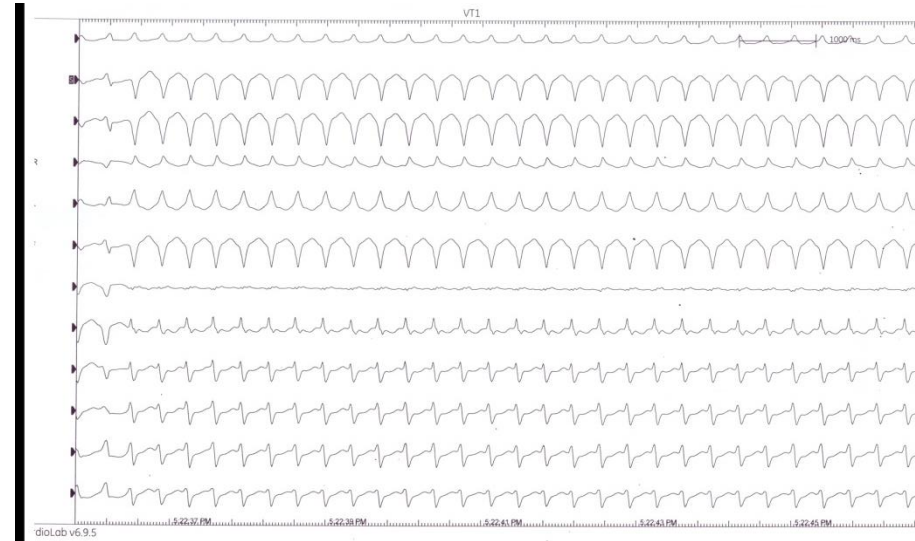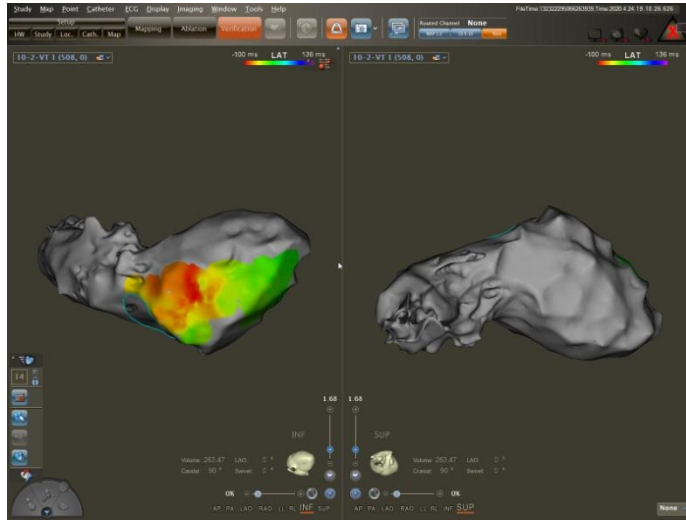
VT2
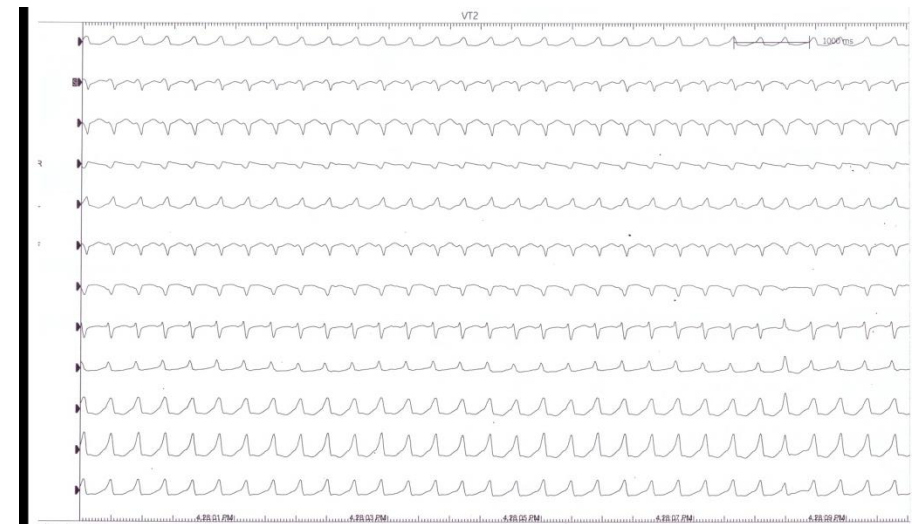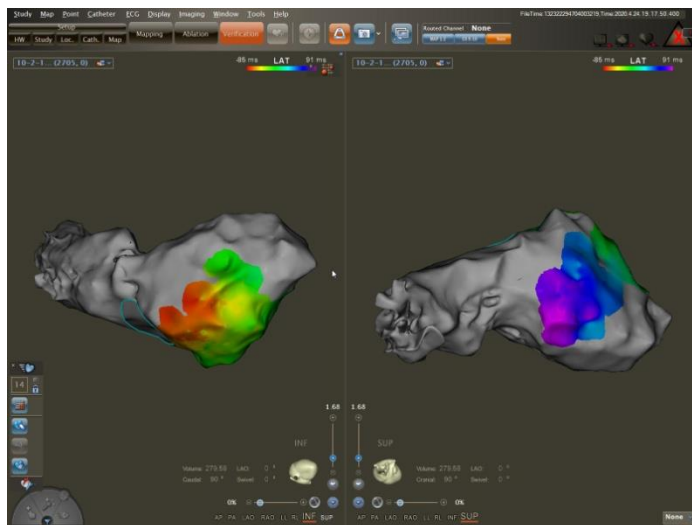
VT's and 3D mapping

VT3
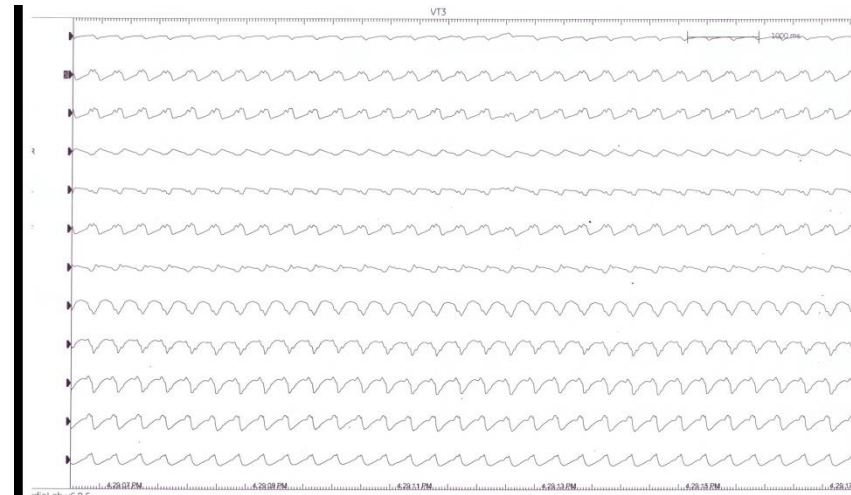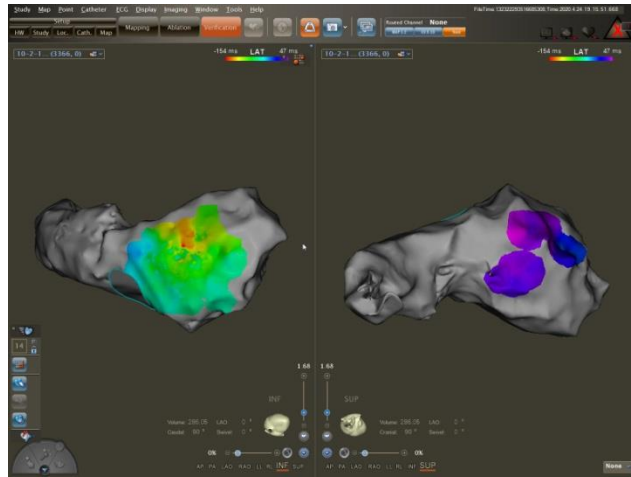
VT4
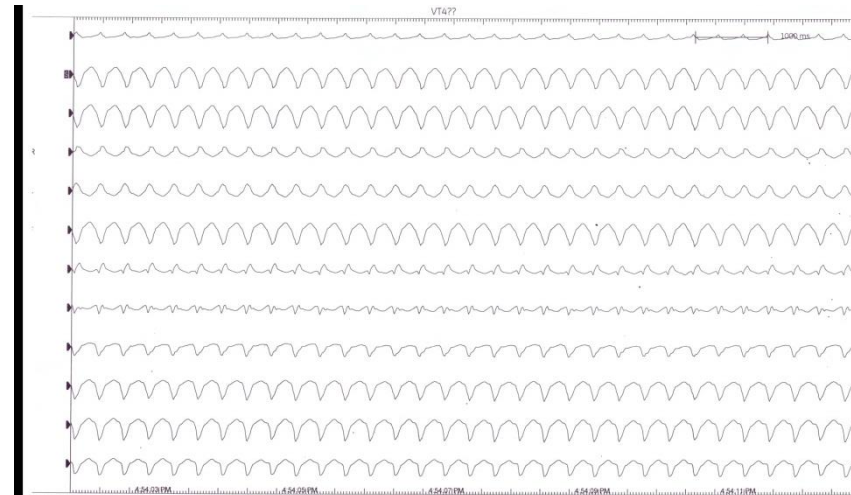
Amiodarone start with IV loading ➜ stopped after 9 months use d/t drug related complication

| Type	ATP Seq	Shocks	Success	ID#	Date	Time hh:mm	Duration hh:mm:ss	Avg bpm A/V	Max bpm A/V	Activity at Onset
VT-NS				4083	14-Oct-2021	08:40	:02	76/156		Active
VT-NS				4082	14-Oct-2021	08:39	:01	76/160		Active
VT-NS				4081	14-Oct-2021	08:37	:01	82/154		Active
VT-NS				4080	14-Oct-2021	08:37	:02	81/156		Active
VT-NS				4079	14-Oct-2021	08:36	:02	79/158		Active
VT-NS				4078	14-Oct-2021	08:36	:03	81/153		Active
VT-NS				4077	14-Oct-2021	08:35	:01	80/161		Active
VT-NS				4076	14-Oct-2021	08:35	:02	80/159		Active
VT-NS				4075	14-Oct-2021	08:35	:01	78/164		Active
VT-NS				4074	14-Oct-2021	08:35	:02	82/159		Active
VT-NS				4073	14-Oct-2021	08:32	:01	86/146		Active
VT-NS				4072	14-Oct-2021	08:31	:02	79/155		Rest
VT-NS				4071	14-Oct-2021	08:30	:01	72/154		Rest
VT-NS				4070	14-Oct-2021	08:30	:02	71/153		Rest
VT-NS				4069	13-Oct-2021	15:02	:01	66/154		Rest
VT	3	20J,35J	Yes	3926	13-Oct-2021	07:52	:43	78/182	—/316	Active
VT	1		Yes	1716	24-Sep-2021	10:55	:14	82/167	—/167	Active
VT	1		Yes	1707	24-Sep-2021	10:14	:32	83/167	90/171	Active
VT	1		Yes	1703	24-Sep-2021	08:12	:14	82/171	—/171	Active

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(Data prior to last session has not been interrogated.)
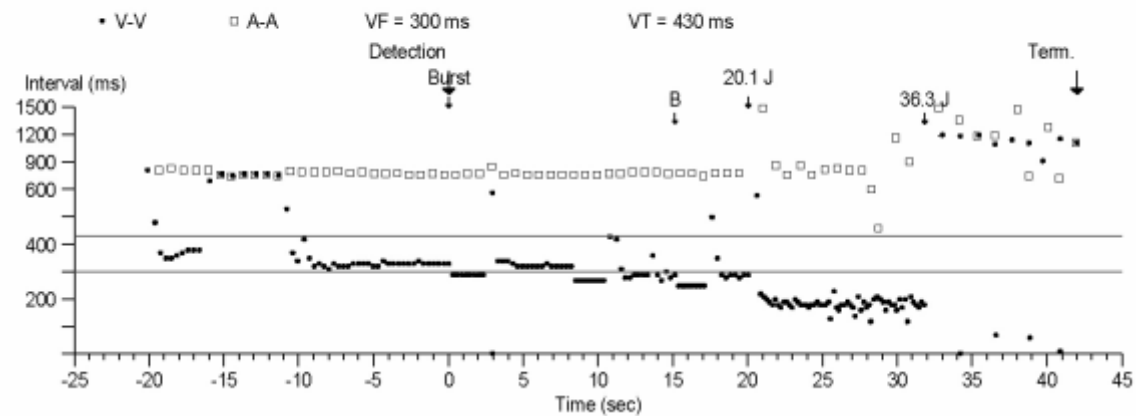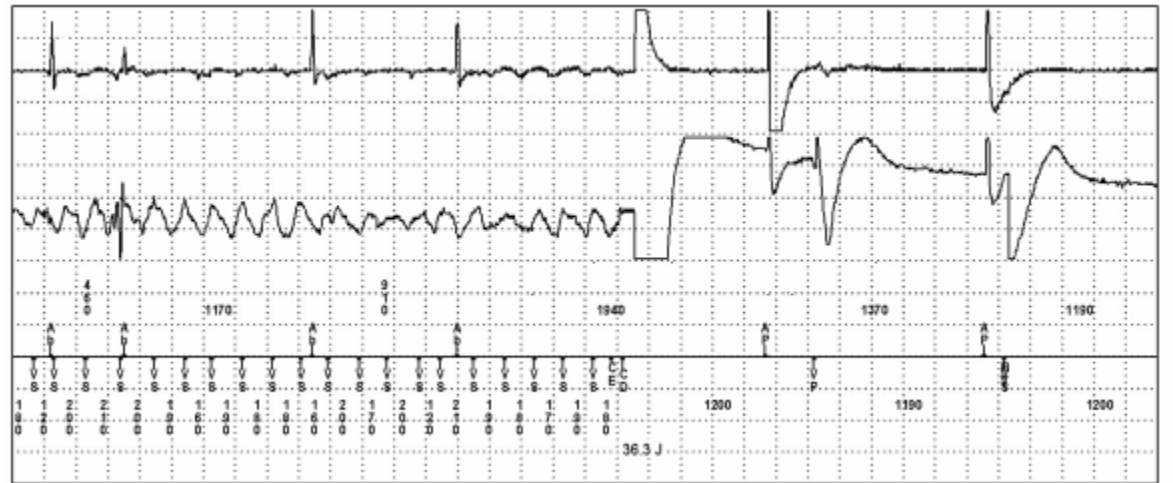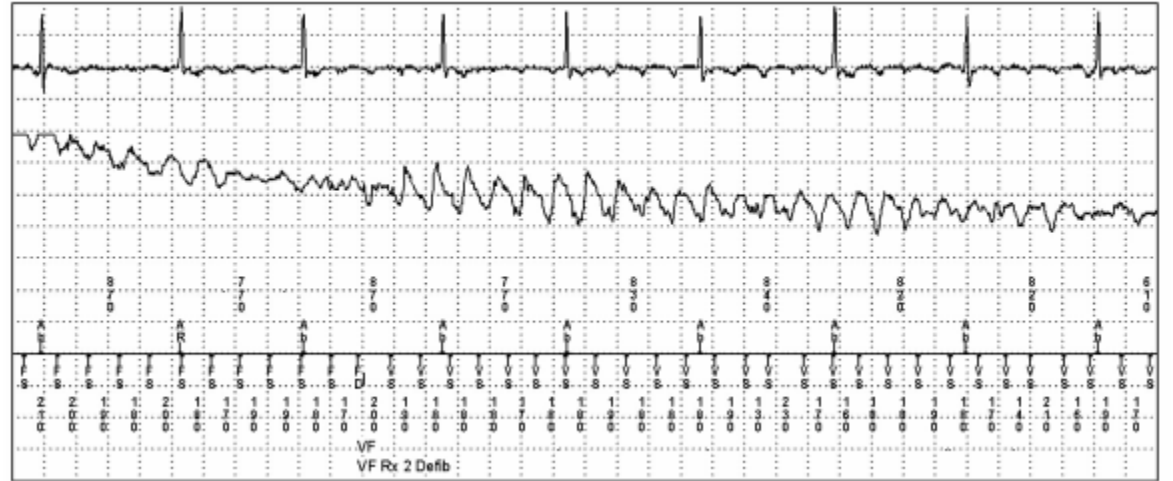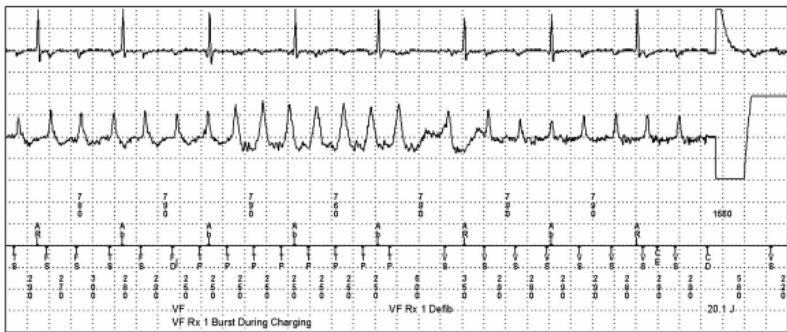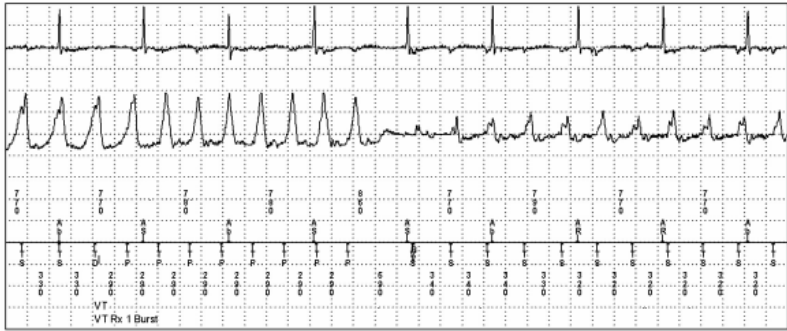
PARTITA trial

Is catheter ablation performed after the first shock more effective than after an electrical storm?

Study design:
  - Randomized prospective multicenter study
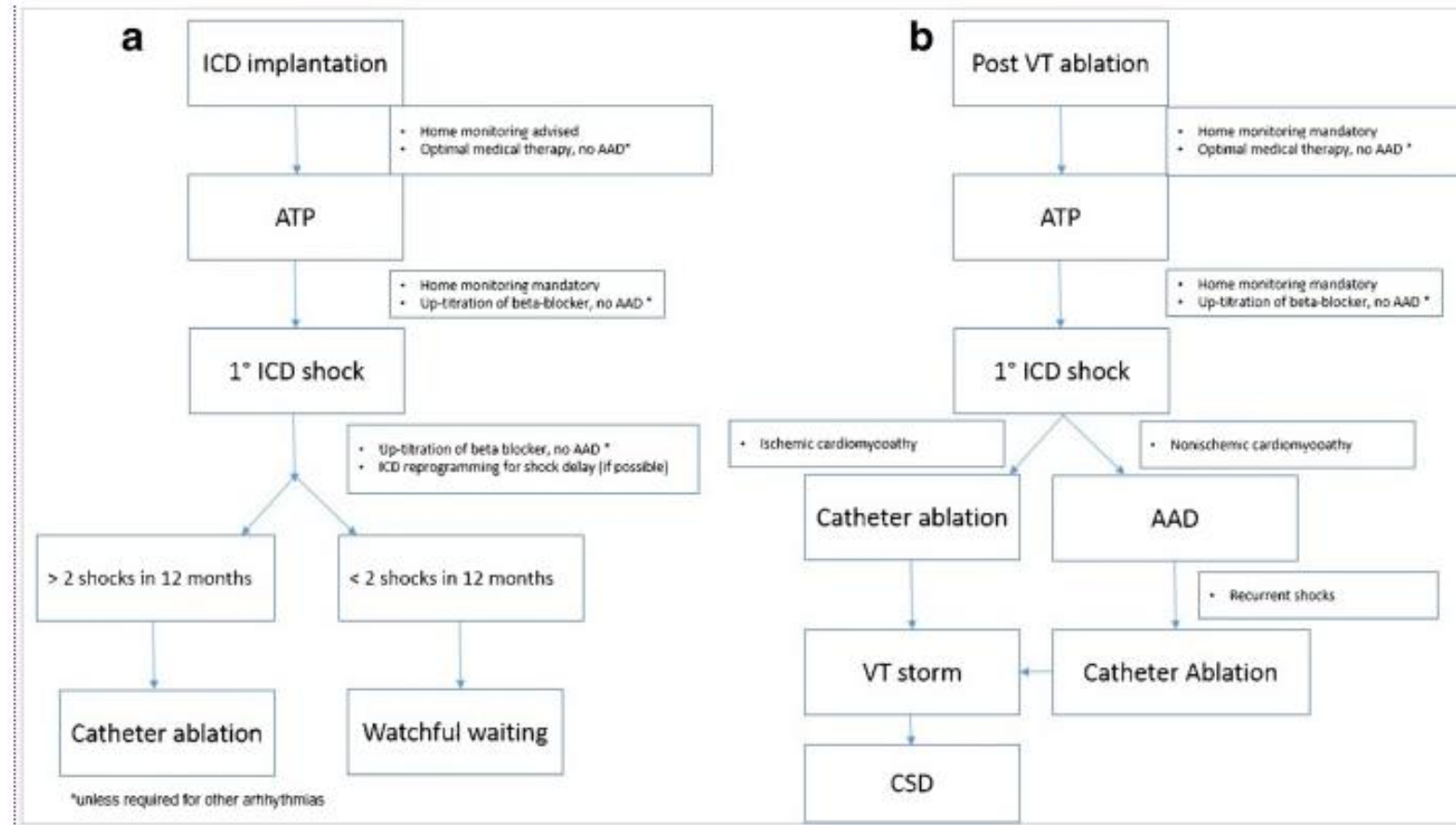 - Follow-up by home monitoring

▪The study began in September 2012

▪19 sites are actively enrolling:
  • 15 in Italy, 1 Portugal, 1 in Switzerland, 1 in France and 1 in Germany

Optimal timing of ablation

VT-naïve patients (A) and after catheter ablation recurrence (B)

My recommandation

1. PVC or VT burden이 많은 환자는 ICD implantation전에 ablation을 시도

2. ICD implantation후 recurrence여부 확인

3. Monitor상 sustained monomorphic VT이 recurr된 경우는 catheter ablation

4. VF나 polymorphic VT인 경우는 AAD을 사용 혹은 증량, 변경.

5. Ablation전에 환자 상태 고려하여 procedure을 계획하고 end point을 설정.

감사합니다

Thank you!