

Under auspices of



1st World Congress on Cardiometabolic Medicine

27-28th April, 2019 Mumbai

TAMING A VT STORM: SYSTEMATIC APPROACH

Dr. Ulhas M. Pandurangi MD., DM
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Arrhythmia Heart Failure Academy

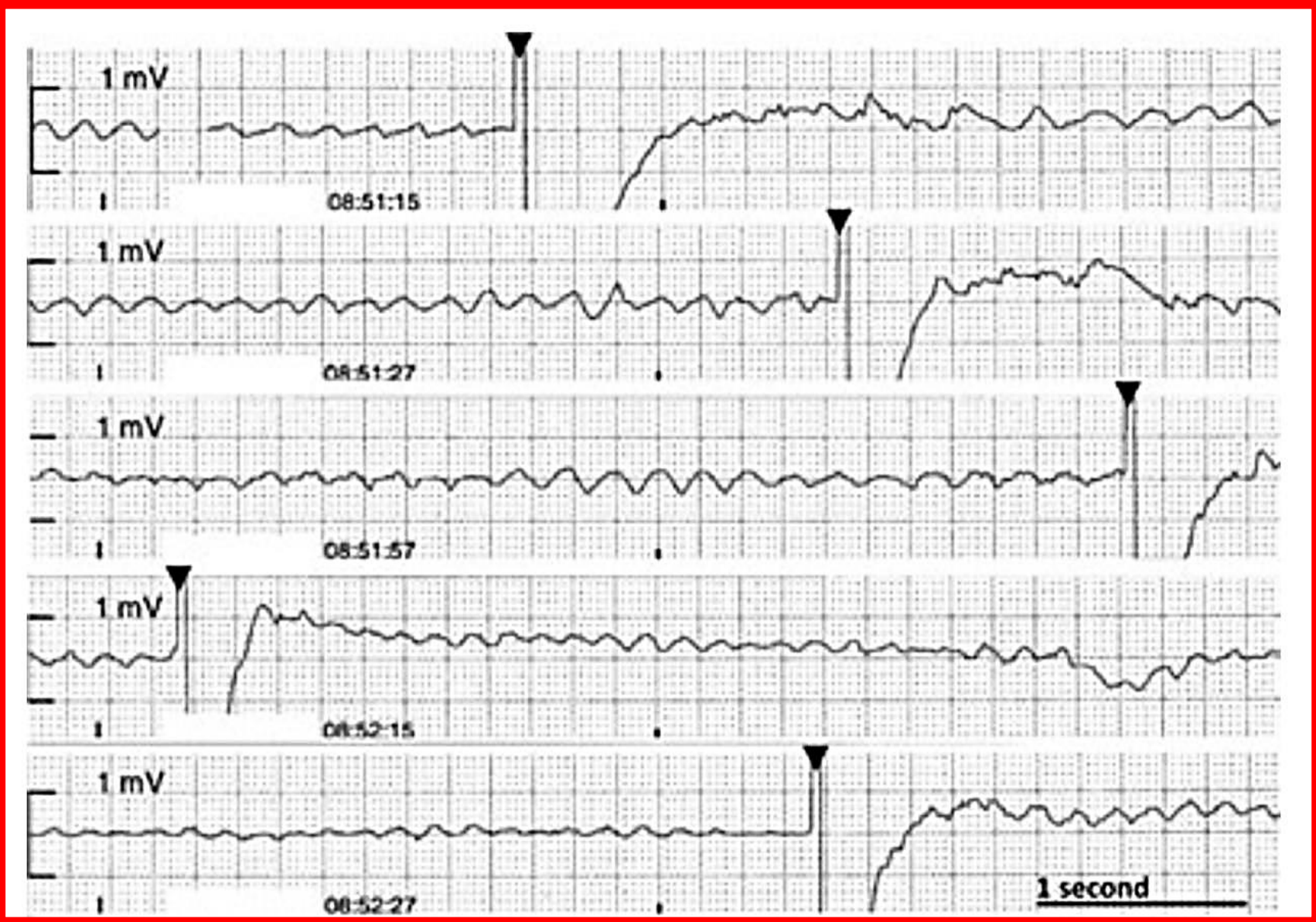
The Madras Medical Mission

Founder President: Tamilnadu Electrophysiology Council

President Elect: Indian Society of Electrocardiology



VT storm



VT storm ??

3 or more sustained episodes of Ventricular Tachycardia, Ventricular Fibrillation within 24 hours

Includes 3 or more therapies (shocks) from an Implantable Cardioverter - Defibrillator

7.4-fold higher risk of death than patients without electrical storm (MADIT II Study)

Etiology of VT storm

Structurally abnormal hearts

Ischemic heart diseases

- Acute or recent myocardial infarction
- Prior myocardial infarction

Non-ischemic cardiomyopathy

- Dilated cardiomyopathy
- Hypertrophic cardiomyopathy
- Arrhythmogenic right ventricular dysplasia/cardiomyopathy

Valvular heart diseases

- Corrected congenital heart diseases
- Myocarditis
- Cardiac sarcoidosis
- Chagas disease
- Metastatic cardiac tumor

Structurally normal hearts

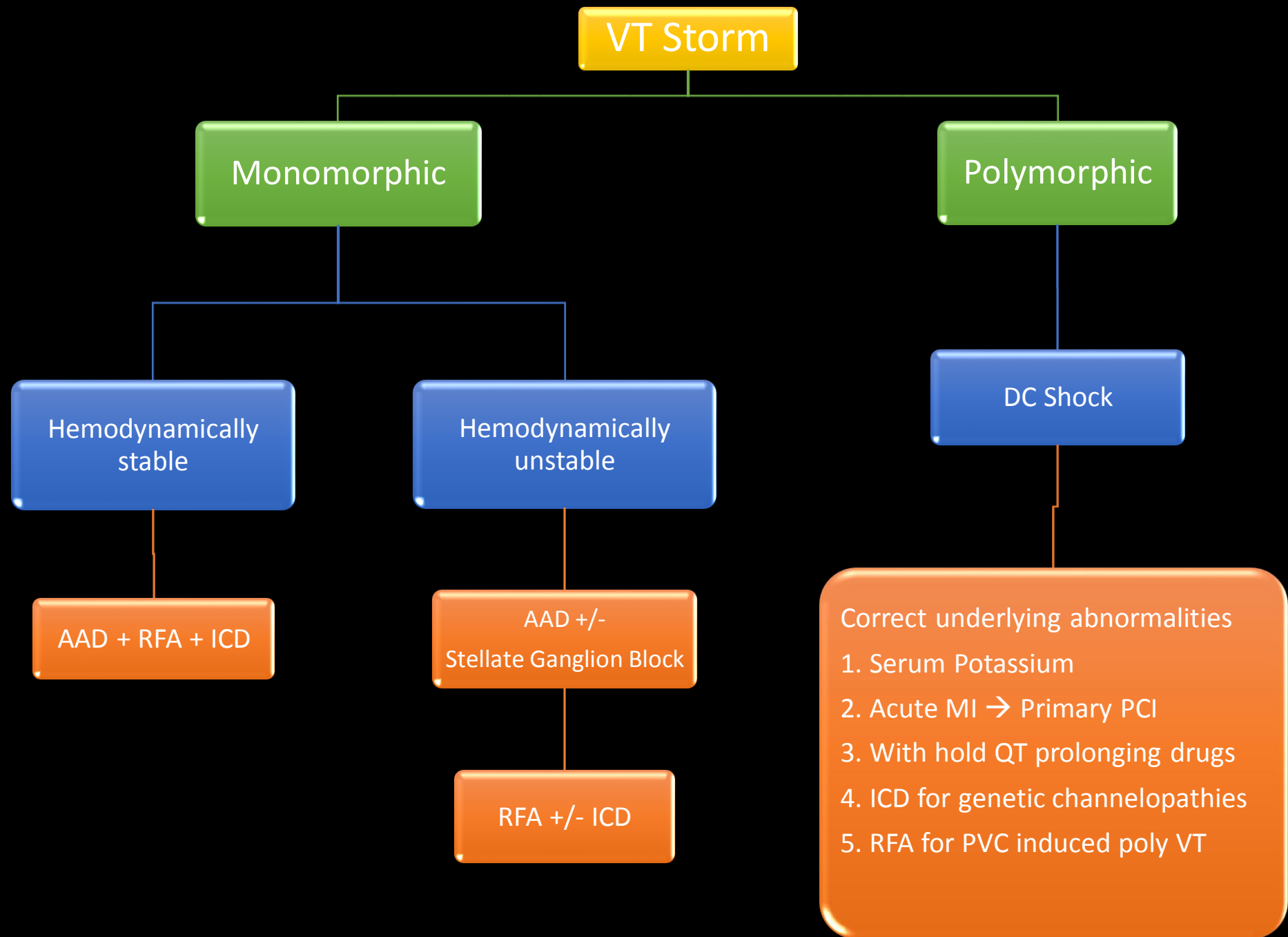
Abnormal electrical substrate (structurally normal hearts)

Primary causes

- Idiopathic
- Brugada syndrome
- Early repolarization syndrome
- Long QT syndrome
- Short QT syndrome
- Catecholaminergic polymorphic ventricular tachycardia

Secondary causes

- Electrolyte abnormalities
- Toxic/drug related
- Endocrinologic
- Perioperative
- Iatrogenic (T wave pacing)



Strategies for Radio Frequency Ablation

Endocardial Ablation

Epicardial Ablation

Ensite NAVX Precision

Automated Bipolar Voltage Map

Automated Late Potential Map

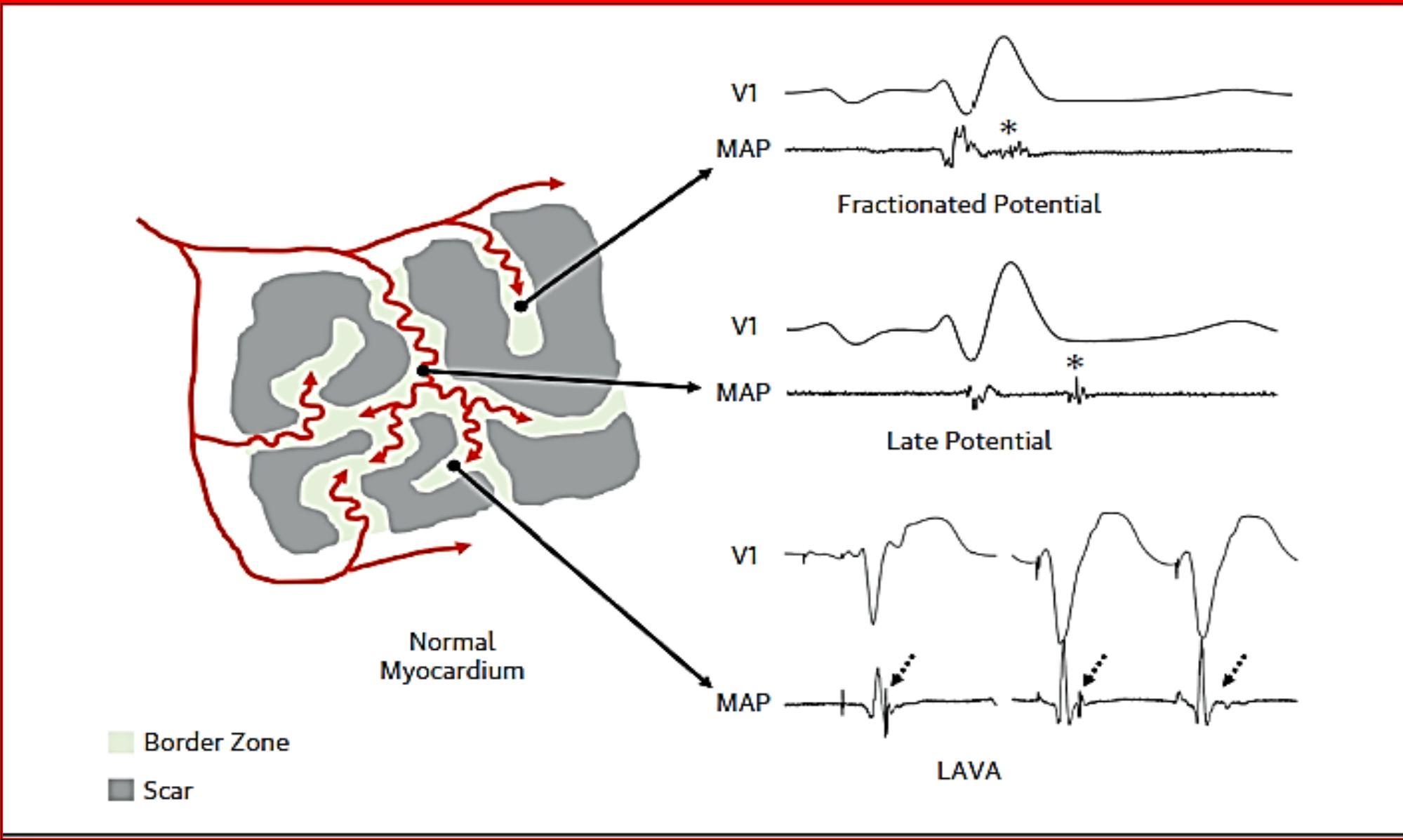
Automated Fractionated Map

Ablation using irrigation catheters

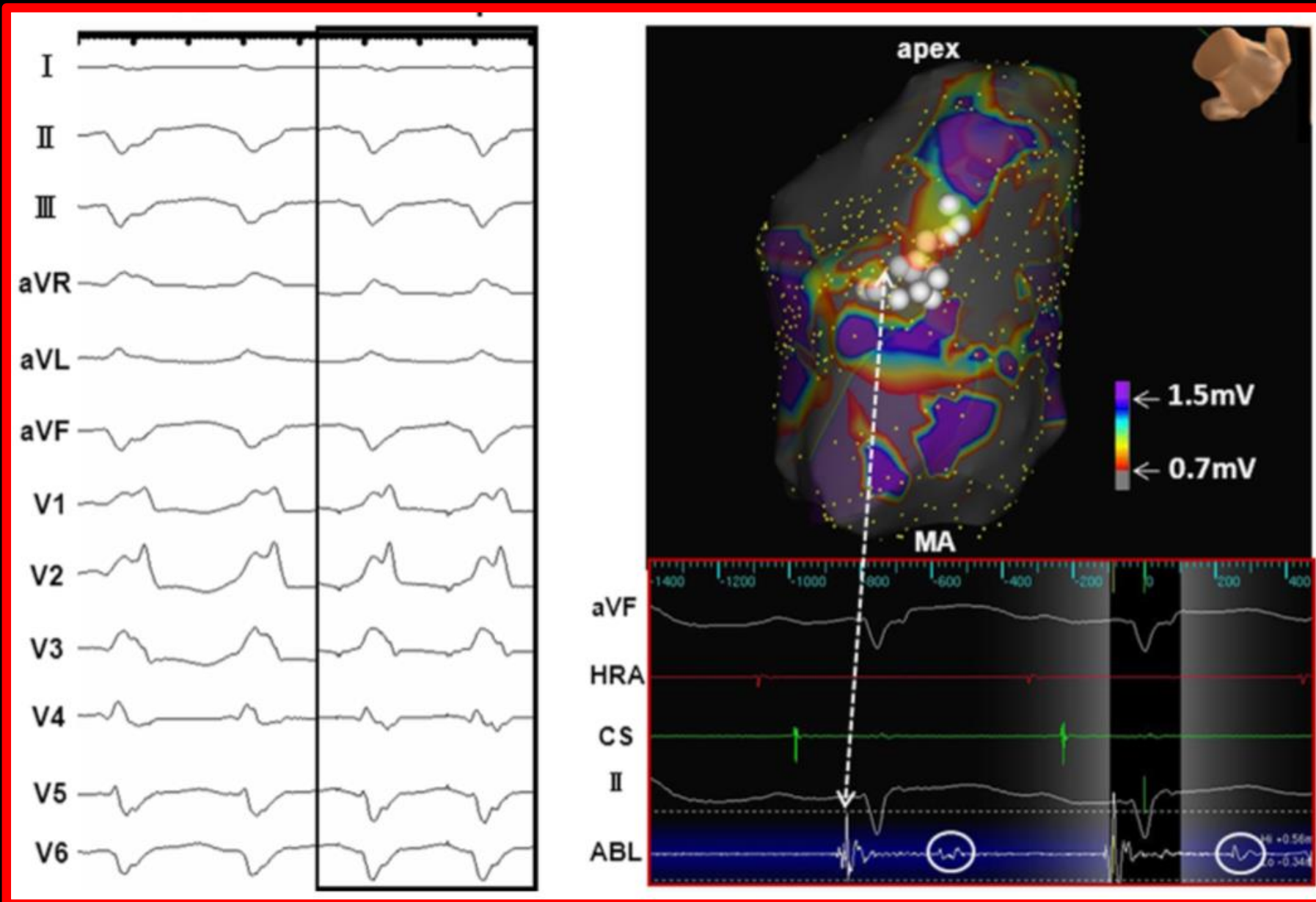
Probability of Epicardial Focus

Normal	6%
ICM	16%
NICM	35%
ARVC	41%
Other CM	18%

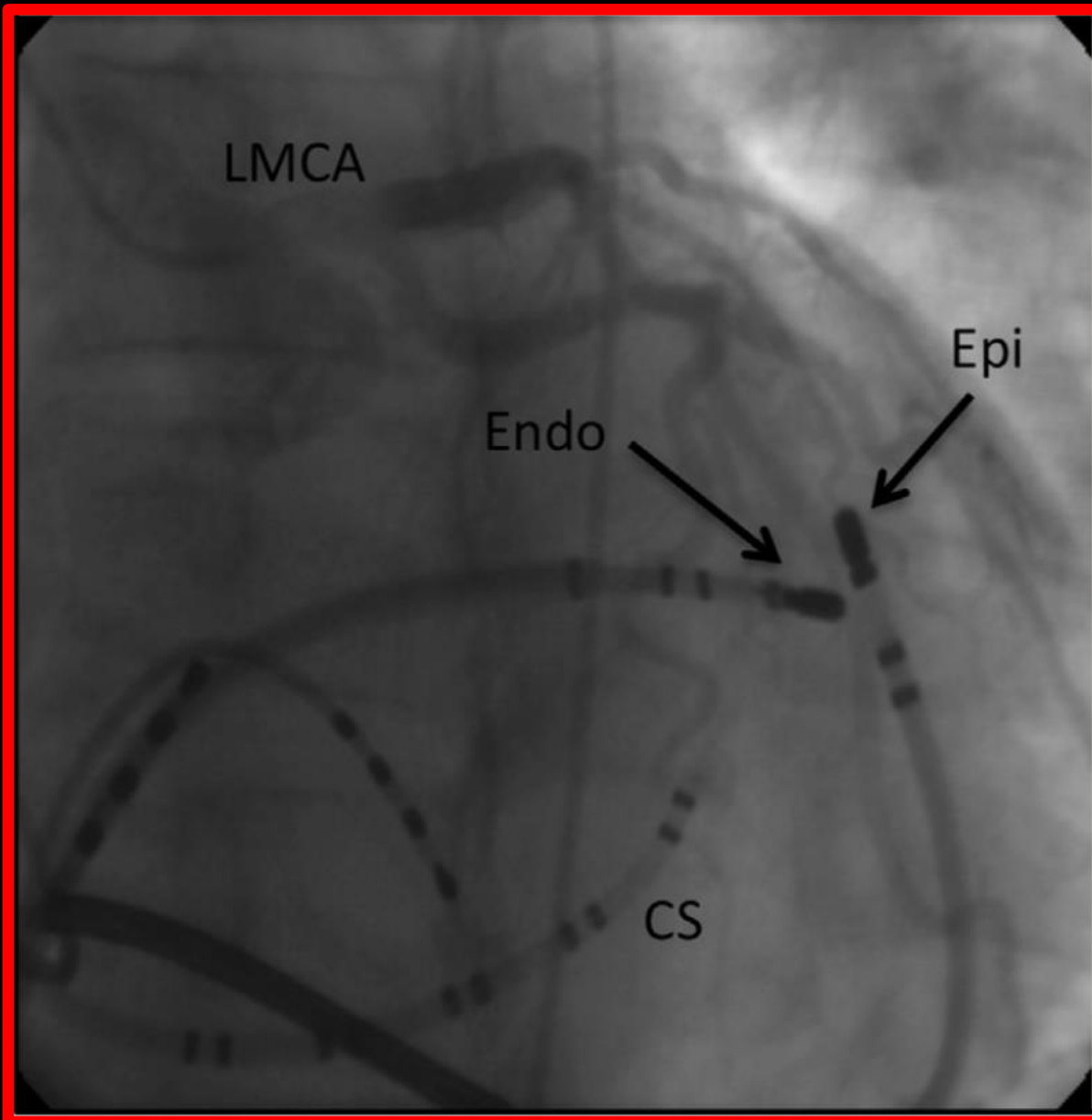
RFA for Scar VT



Pace Mapping and Scar Mapping

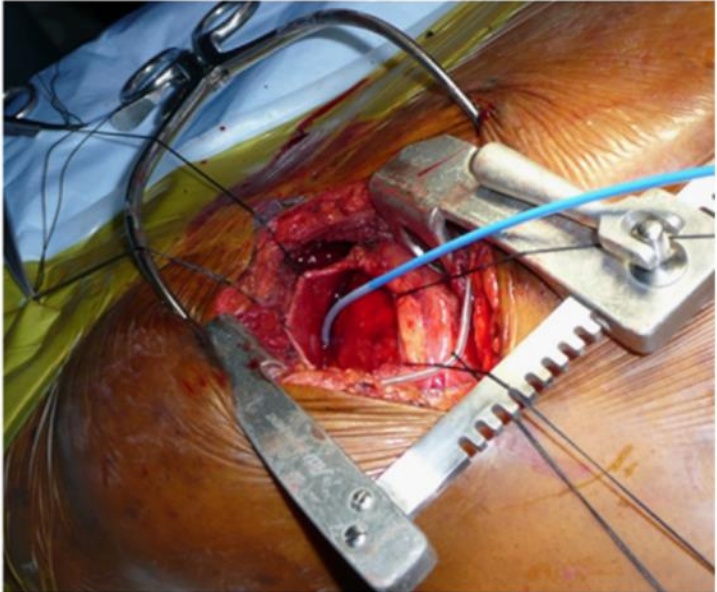
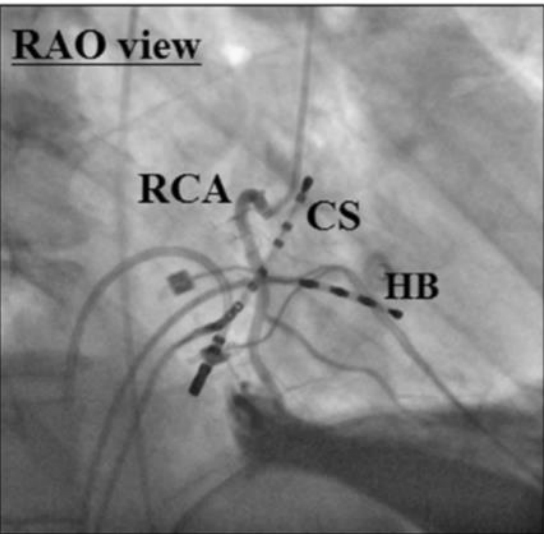
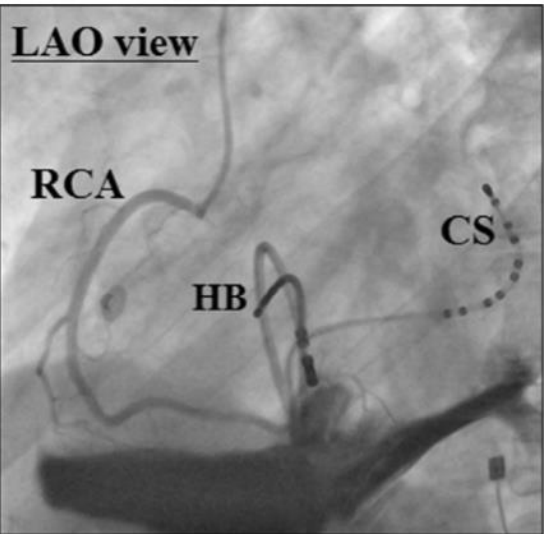


Endo – Epicardial ablation



Epicardial ablation

S/P Open heart surgery – Pericardial adhesion – Hybrid procedure



Case 1

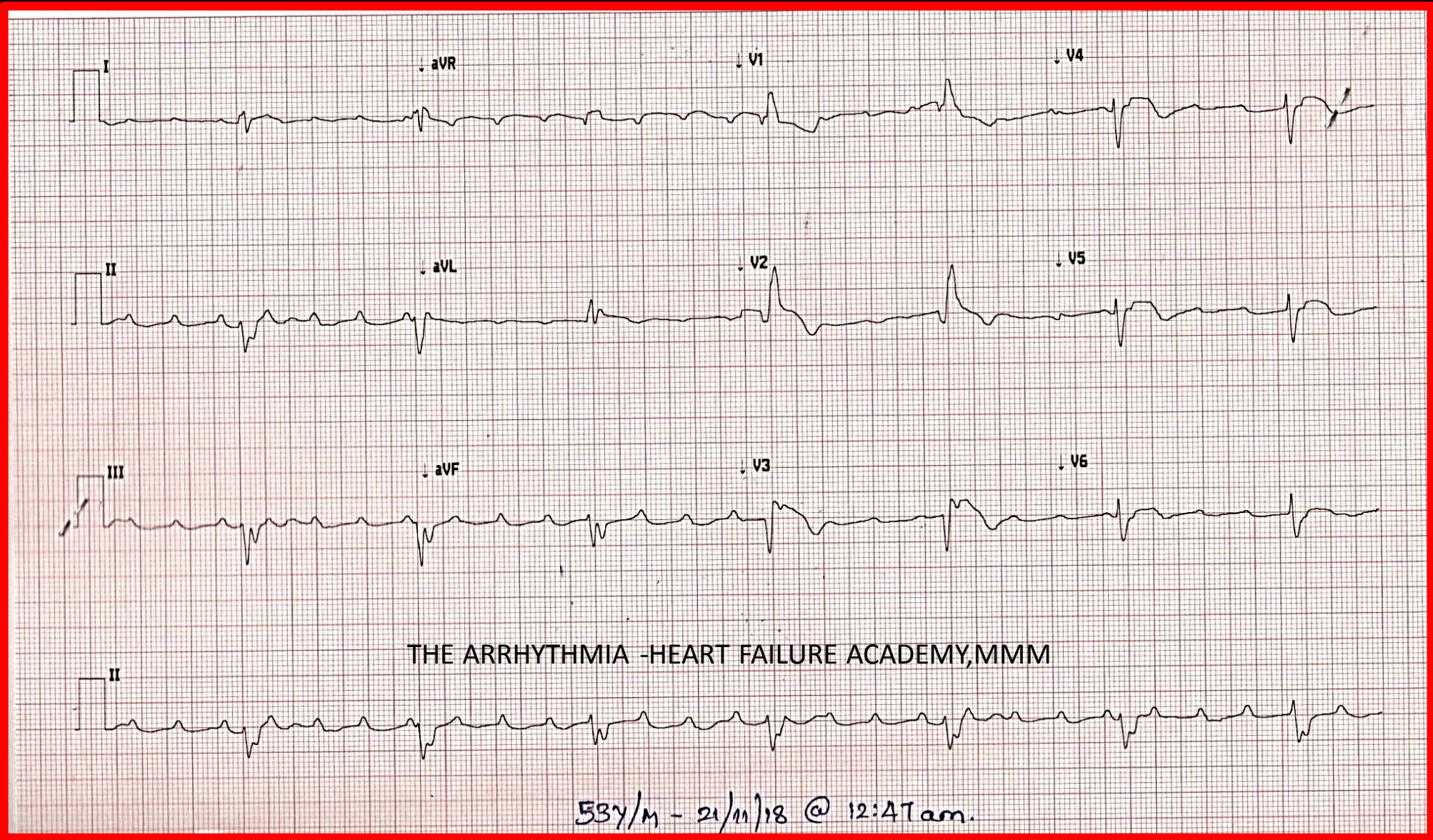
53Y, M, Known patient of Hypertension, Diabetes Mellitus

Presents to the ER on 20/11/18 with Shock

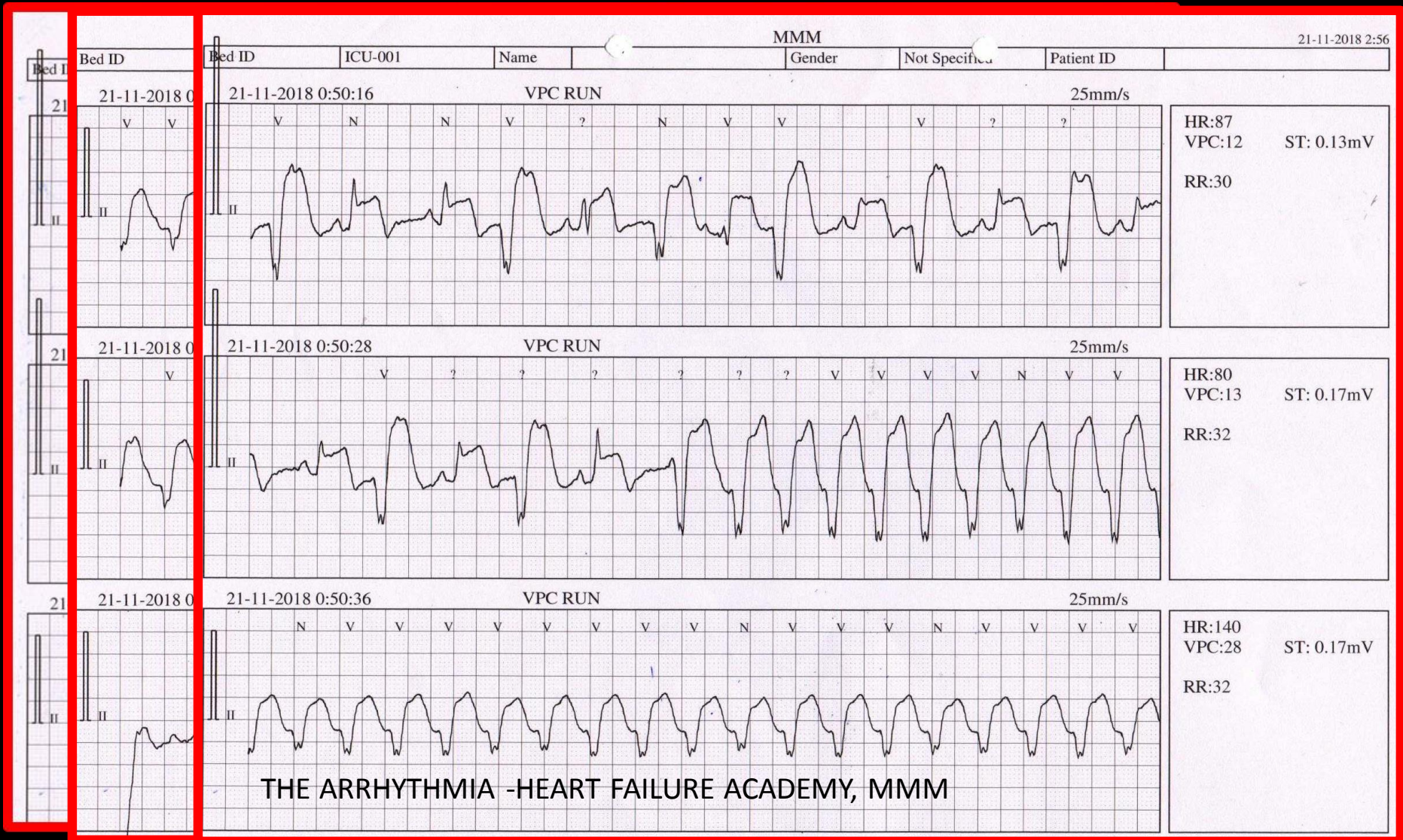
H/O chest pain

Diagnosis → Extensive AWTMI with Cardiogenic shock

ECG on presentation



TPI placed, pt. develops a VT Storm



TPI placed

IABP + inotropes for hemodynamic support

What will you do next ?

Primary PCI

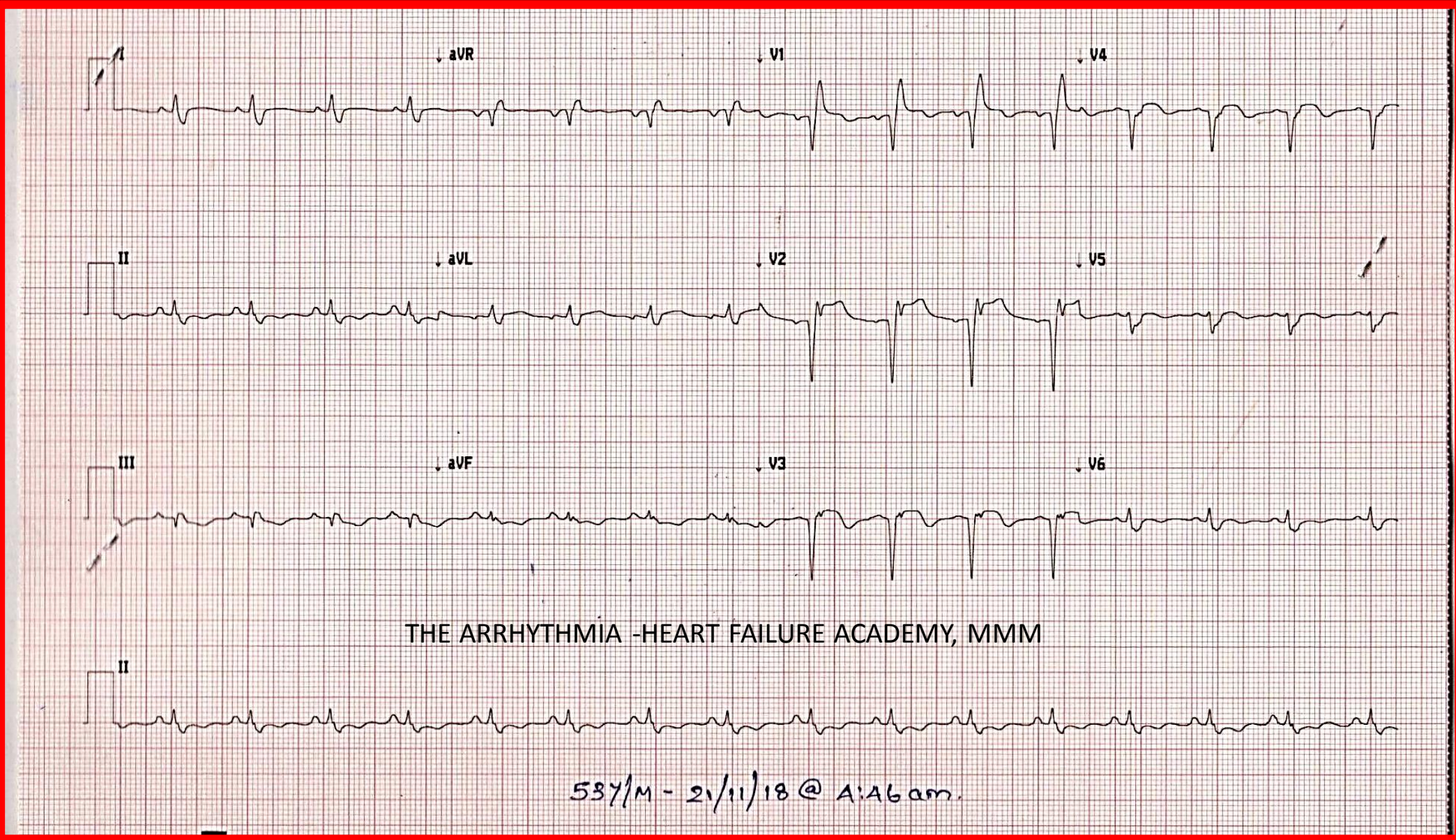
PRE PCI



POST PCI



POST PCI- ECG



THE ARRHYTHMIA -HEART FAILURE ACADEMY, MMM

537/M - 21/11/18 @ 1:46 am.

Case 2

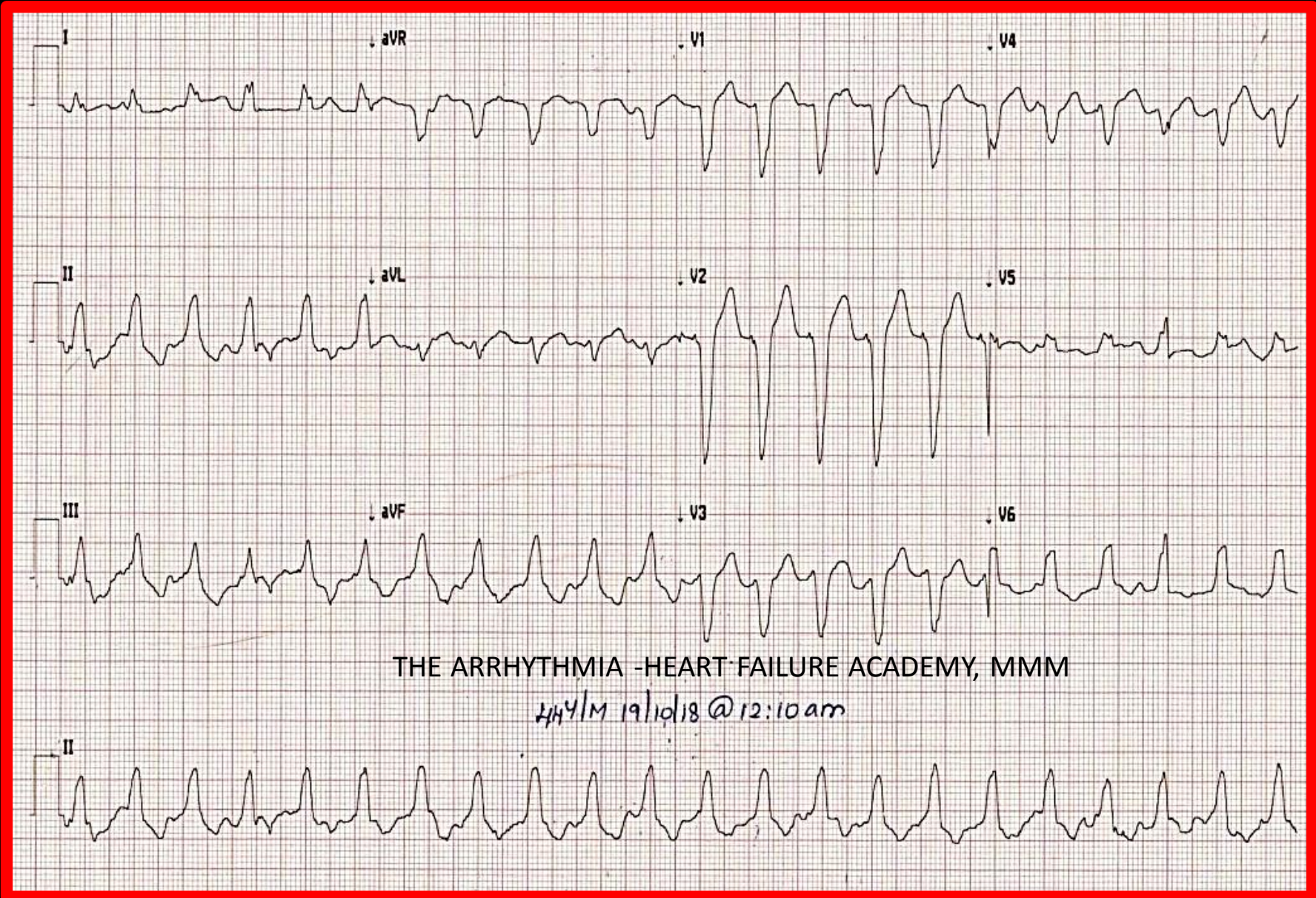
46Y, M, Known patient of ARVD

Cardiac arrest → AICD (2013)

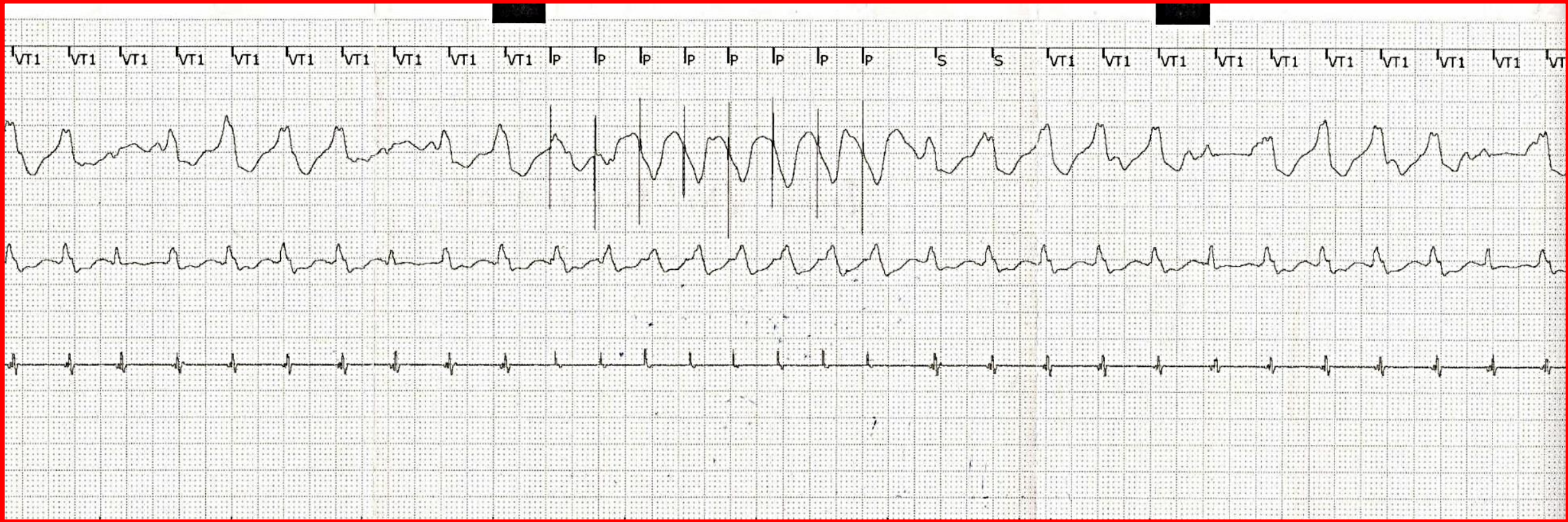
Feb'18 → VT storm (6 appropriate shocks) within 12 hours

Incessant VT → Refractory to Amiodarone, Lignocaine, Multiple manual DC shocks

ECG during VT



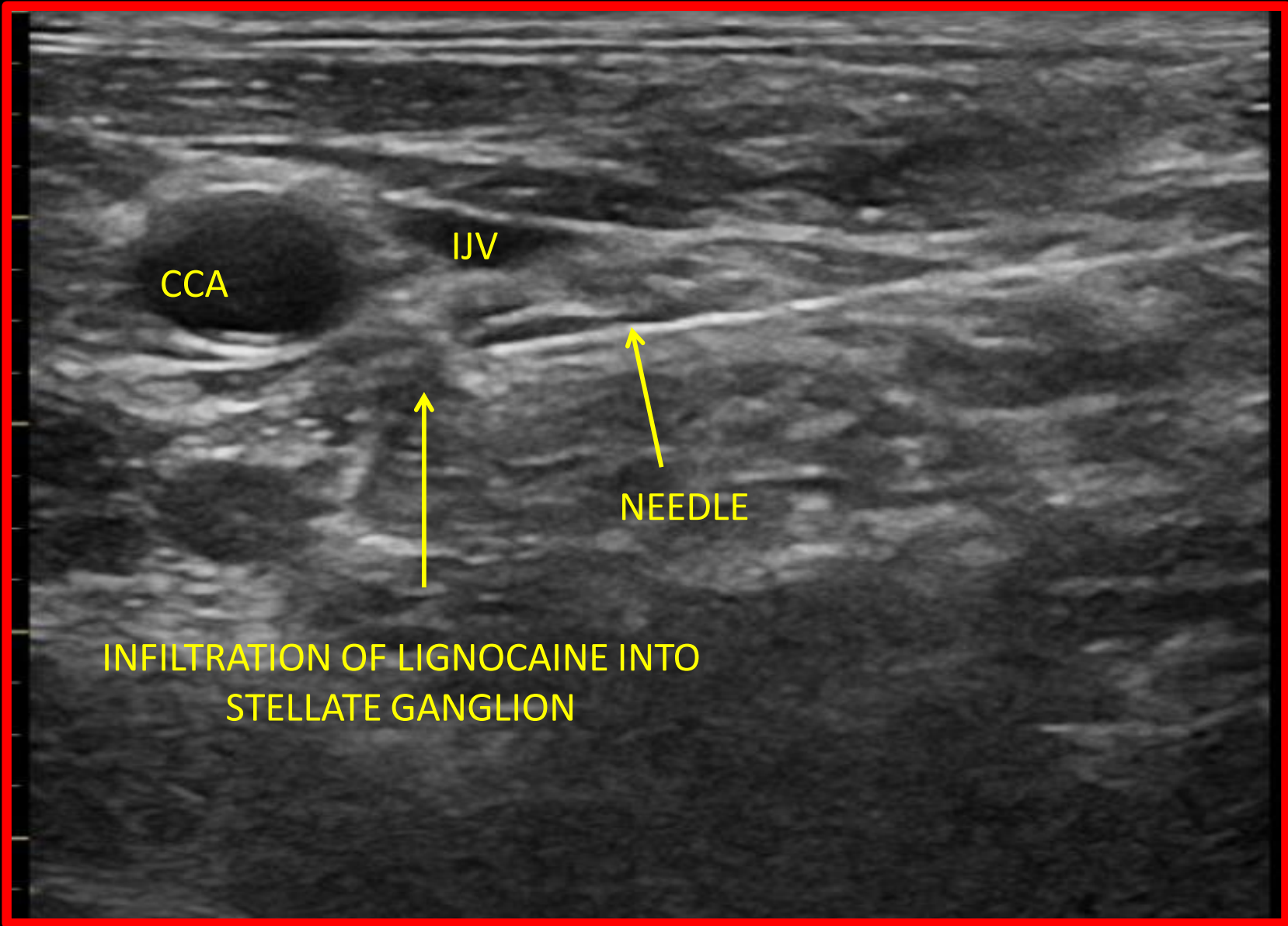
Unsuccessful Burst Pacing



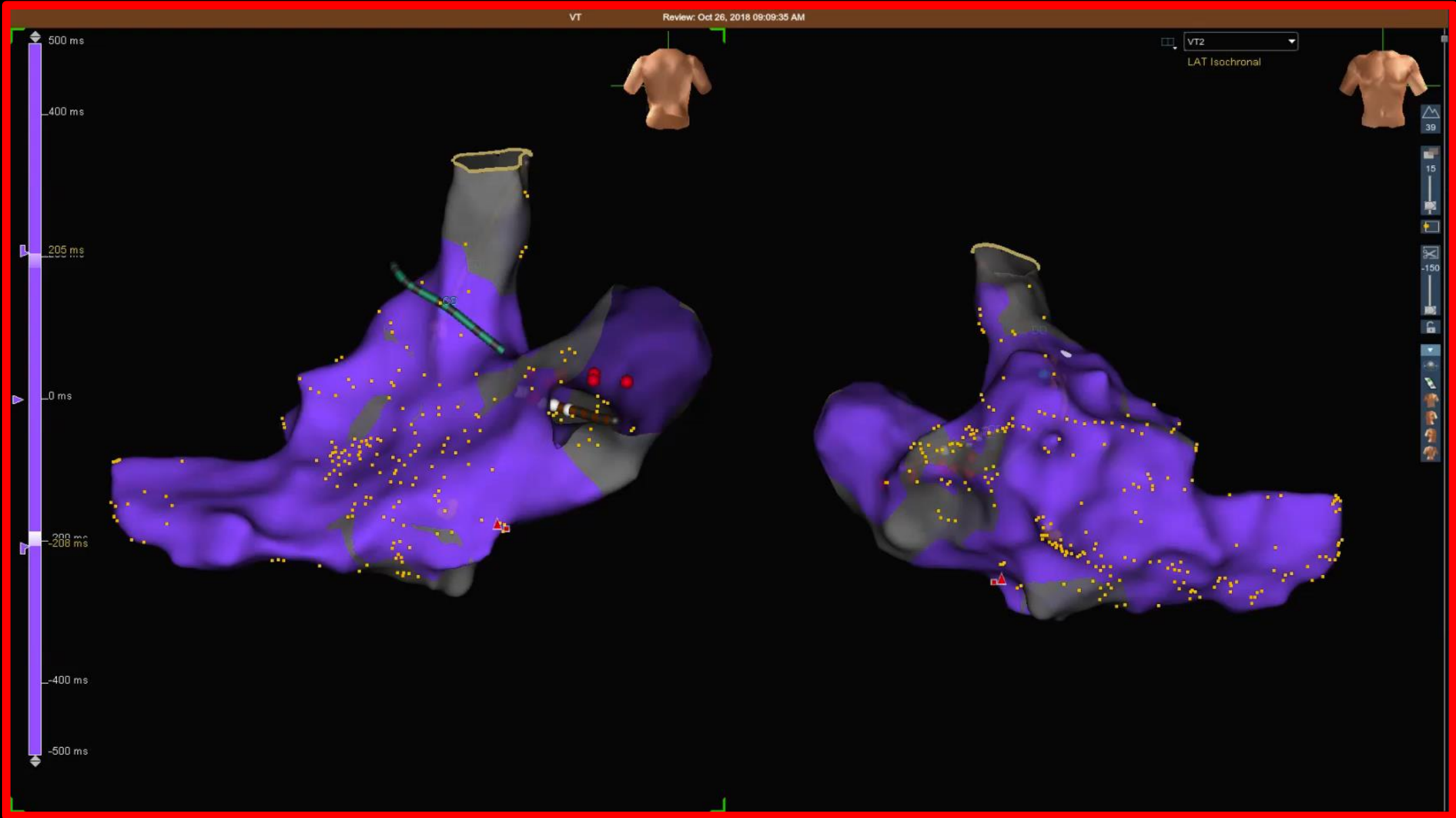
Pt. continues to have VT

What will you do?

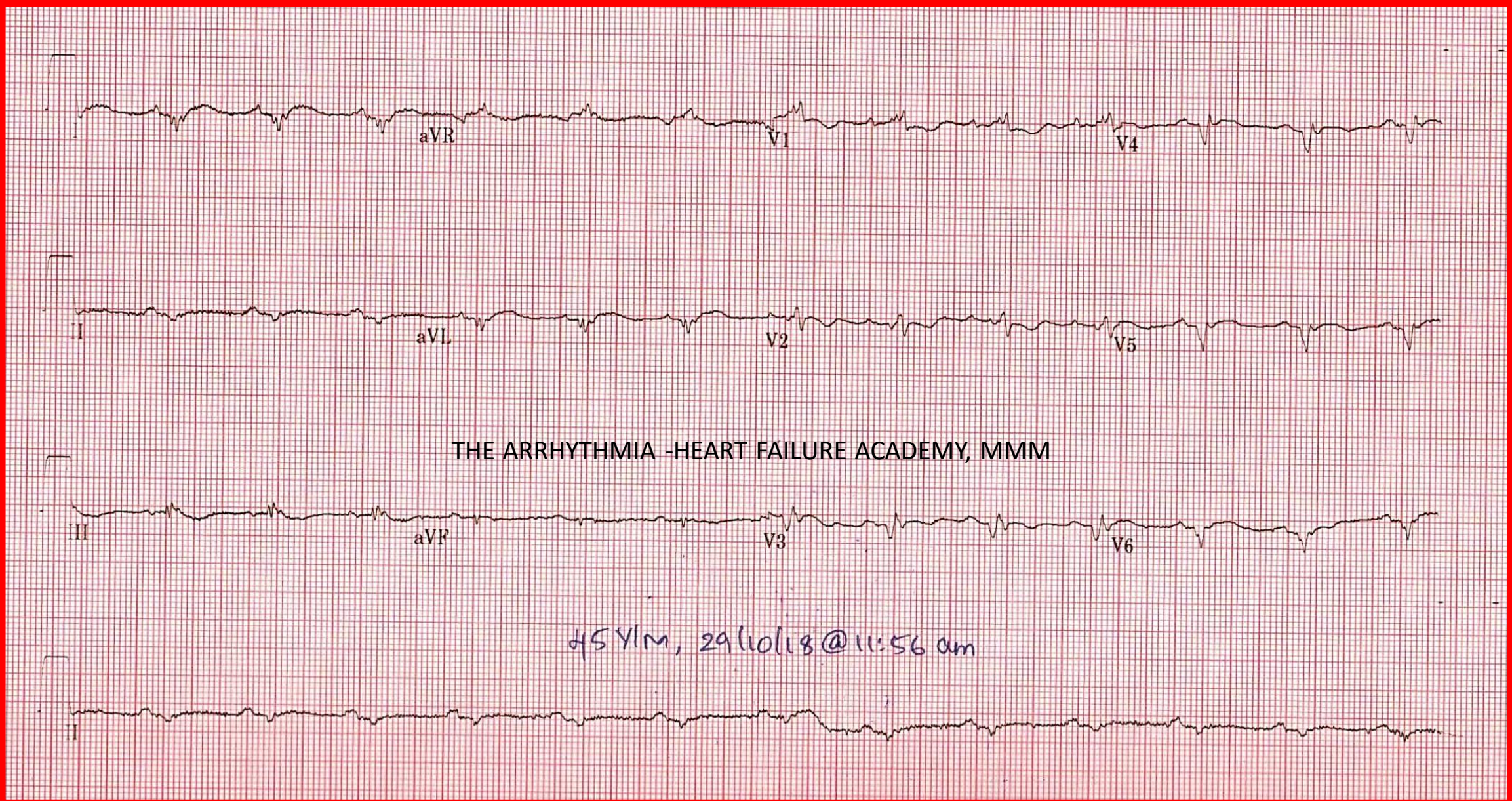
Temporary Stellate Ganglion Block



Propagation map



Post RFA – No recurrence



CASE 3

69Y, M, CAD – Triple Vessel Disease,
Moderately Severe LV dysfunction. LVEF:32%

S/P CABG, 1997

Documented monomorphic VT [RBBB Morphology]

S/P Dual Chamber ICD, 2017

Patient presents with VT storm

VT/VF Counters

Device: Maximo II DR D284DRG

Serial Number: PZM611060S

Date of Visit: 15-Nov-2017 11:54:32

Patient: [REDACTED]

ID: [REDACTED]

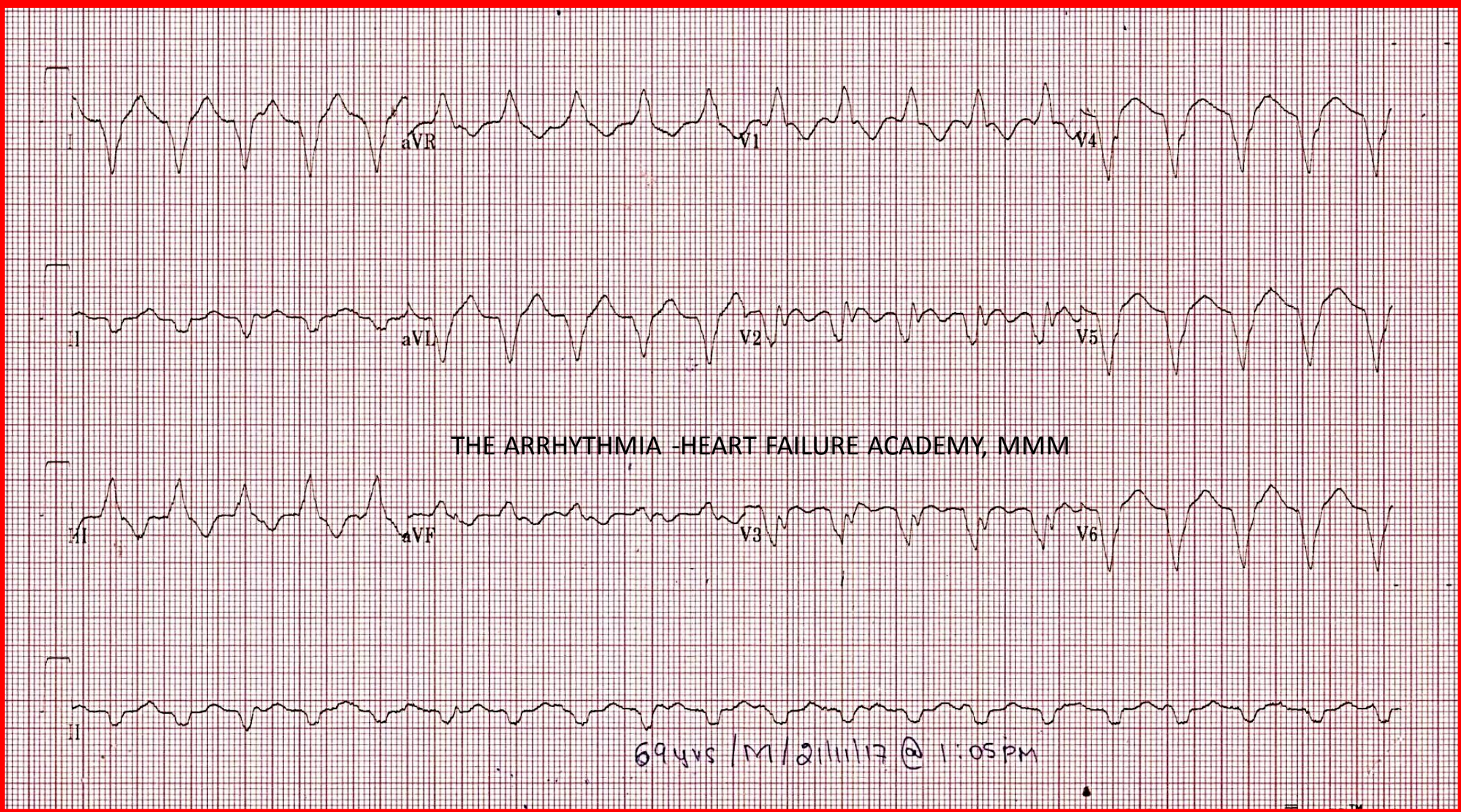
Physician: DR.ULHAS.M.PANDURANG 044-26561801

Prior Session	Last Session	Device Lifetime
16-Sep-2017 to 07-Nov-2017 52 days	07-Nov-2017 to 15-Nov-2017 8 days	Total (Since 10-Oct-2011) 73 months

VT/VF Counters

VF	1	0 ↓	2
FVT	0	0	0
VT	45	0 ↓	49
Monitored VT (133 - 150 bpm)	37	0 ↓	
VT-NS (>4 beats, >150 bpm)	184	2 ↓	
PVC Runs (2-4 beats)	<0.1 per hour	0.2 per hour ↑	
PVC Singles	2.7 per hour	5.2 per hour ↑	
Runs of VRS Paces	0.0 per hour	0.0 per hour	
Single VRS Paces	0.0 per hour	0.0 per hour	

ECG during VT



Arrhythmia Episode List

Device: **Maximo II DR D284DRG**

Serial Number: **PZM611060S**

Date of Visit: **15-Nov-2017 11:54:32**

Patient

ID:

Physician: **DR.ULHAS.M.PANDURANG 044-26561801**

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		Yes	154	05-Nov-2017	03:40	:08	79/200	—/200	Rest
VT	2		Yes	138	04-Nov-2017	10:33	:16	73/182	—/188	Rest
VT	1		Yes	137	04-Nov-2017	10:33	:08	71/182	—/182	Rest
VT	3	25J	Yes	136	04-Nov-2017	10:31	:01:41	73/171	77/207	Rest
VT	2		Yes	111	03-Nov-2017	23:36	:02:06	94/176	97/188	Rest
VT	3		Yes	89	03-Nov-2017	19:15	:25	80/176	—/176	Rest
VT	2		Yes	88	03-Nov-2017	18:37	:15	80/188	—/188	Rest
VT	1		Yes	87	03-Nov-2017	17:55	:39	80/158	—/158	Rest
VT	3		Yes	85	03-Nov-2017	17:14	:26	85/167	—/167	Rest
VT	1		Yes	84	03-Nov-2017	10:49	:10	82/167	—/—	Rest
VT	2		Yes	59	03-Nov-2017	09:03	:28	79/162	80/162	Rest
VT	1		Yes	58	03-Nov-2017	04:51	:08	71/188	—/188	Rest
VT	1		Yes	57	03-Nov-2017	02:34	:09	73/188	—/188	Rest
VT	1		Yes	56	03-Nov-2017	01:51	:09	77/188	—/188	Rest
VT	1		Yes	55	11-Oct-2017	16:05	:10	83/158	—/158	Rest
VT	1		Yes	53	11-Oct-2017	16:04	:18	85/158	86/158	Rest
VT	1		Yes	52	11-Oct-2017	16:03	:34	86/158	87/158	Rest
VT	1		Yes	51	11-Oct-2017	16:02	:32	87/158	—/158	Rest
VT	2		Yes	49	11-Oct-2017	16:01	:19	88/158	—/158	Rest
VT	2		Yes	48	11-Oct-2017	16:00	:21	91/158	—/158	Rest
VT	2		Yes	47	11-Oct-2017	15:59	:19	91/158	—/158	Rest
VT	1		Yes	45	11-Oct-2017	15:57	:30	90/158	92/158	Rest
VT	2		Yes	38	11-Oct-2017	15:26	:20	87/158	—/158	Rest
VT	2		Yes	37	11-Oct-2017	15:25	:29	91/158	92/158	Rest
VT	1		Yes	36	11-Oct-2017	15:24	:10	86/154	—/154	Rest
VT	1		Yes	16	09-Apr-2014	13:15	:11	74/154	—/154	Active
VT	2		Yes	13	22-Mar-2014	13:23	:01:11	79/154	—/154	Active
VT	3		Yes	11	22-Mar-2014	13:20	:01:04	88/154	88/154	Active
VT	2		Yes	9	22-Mar-2014	13:18	:20	83/158	—/—	Active
VF	0	16J	Yes	1	10-Oct-2011	11:08	:06	—/316	—/316	Rest

Replacement Indication

Quick Look II Report

Device: **Maximo II DR D284DRG**

Serial Number: **PZM611060S**

Date of Visit: **15-Nov-2017 11:54:32**

Patient: [REDACTED]

ID: [REDACTED]

Physician: **DR.ULHAS.M.PANDURANG 044-26561801**

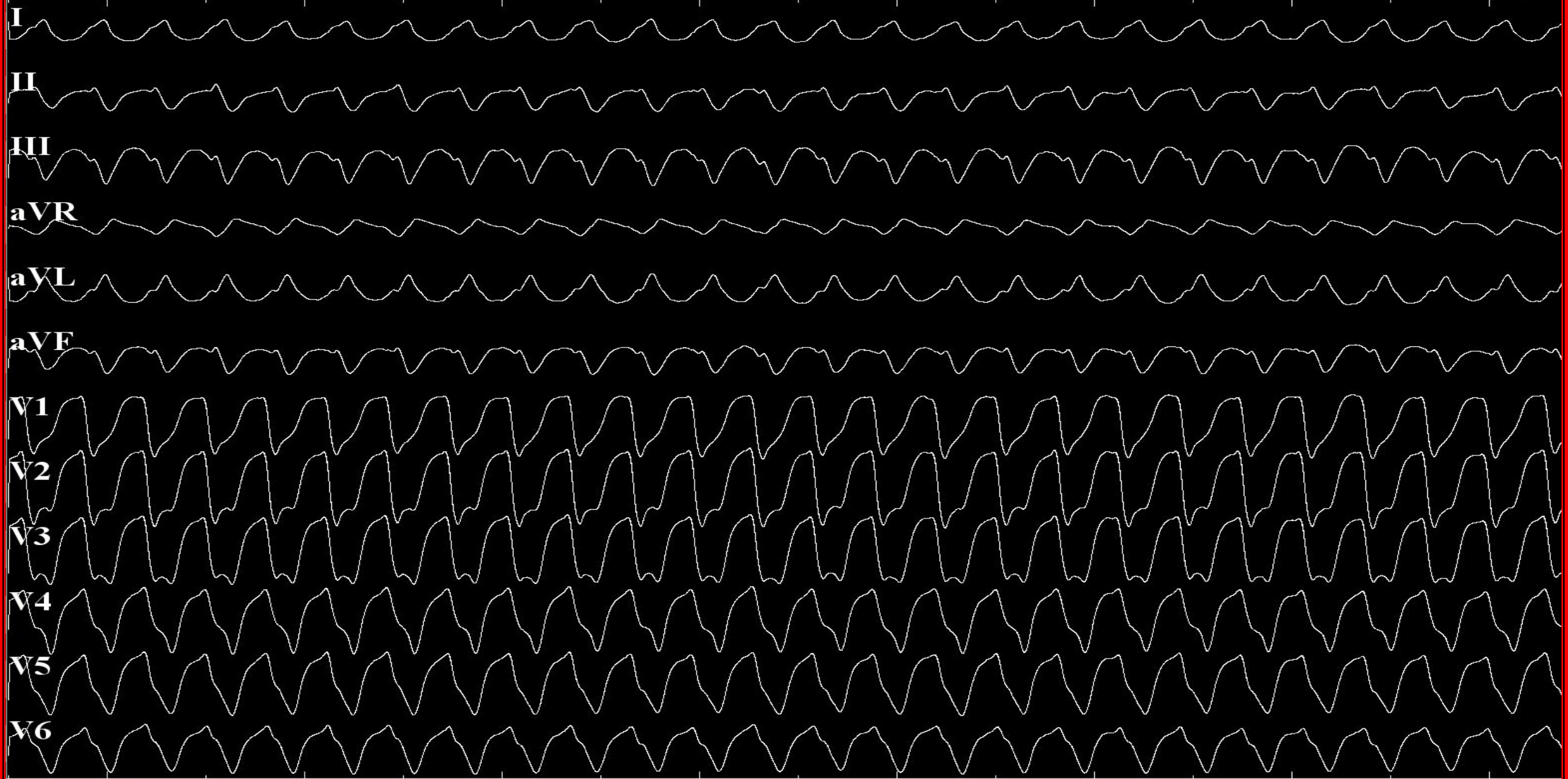
History: Unexplained Syncope + Inducible VT, Normal Sinus, Normal AV Conduction, NYHA Class III

Device Status (Implanted: 10-Oct-2011)

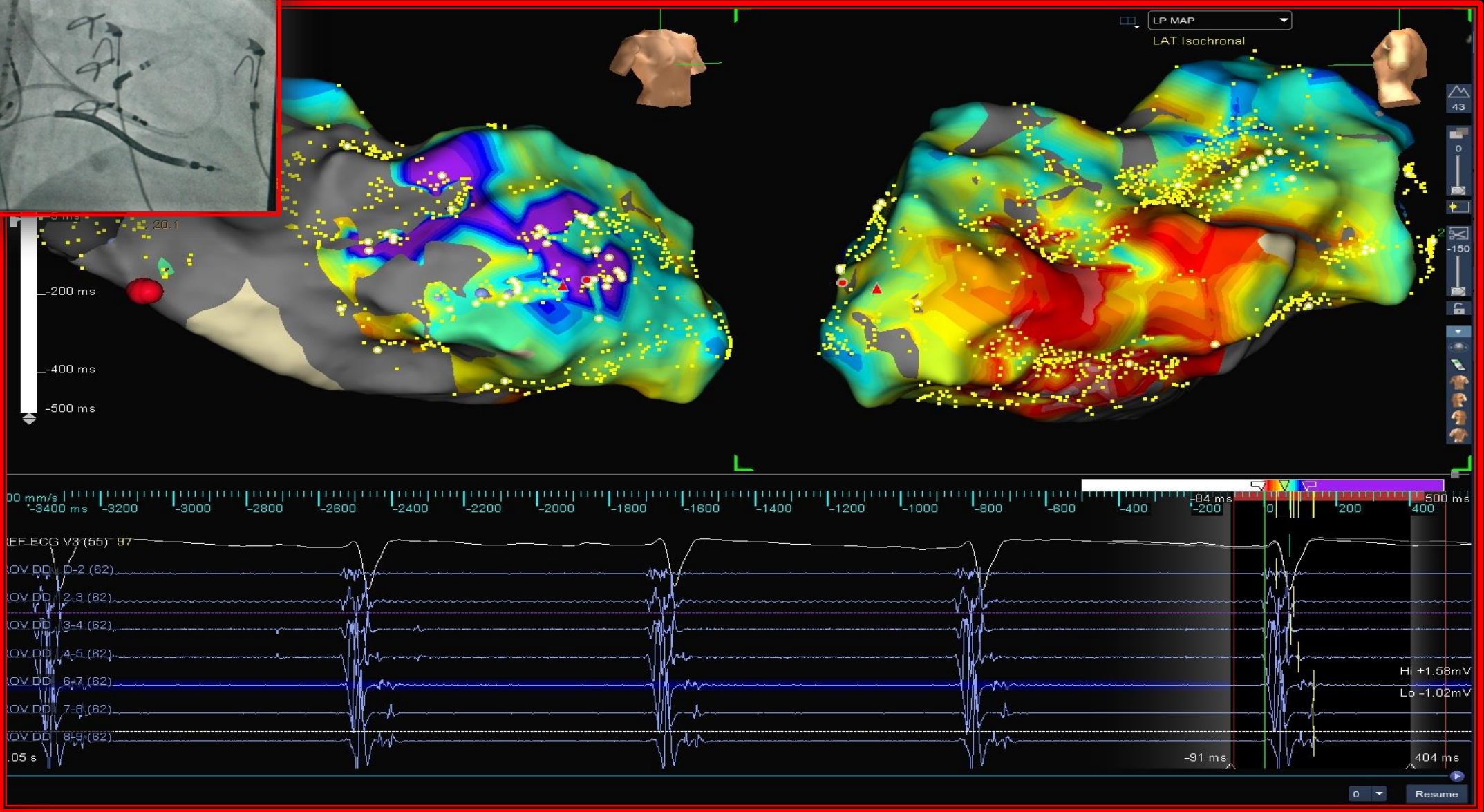
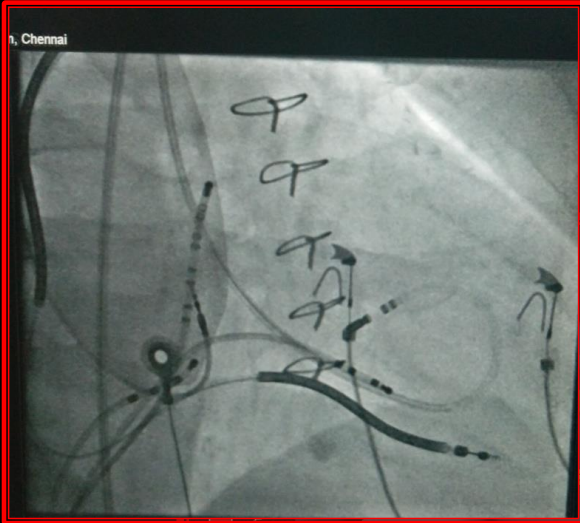
Battery Voltage (RRT=2.63V on 02-Nov-2017)	2.61 V RRT	(15-Nov-2017)
Last Full Charge	15.3 sec	(12-Oct-2017)
	Atrial(4076)	RV(6947)
		SVC
Pacing Impedance	437 ohms	551 ohms
Defibrillation Impedance		RV=44 ohms SVC=49 ohms
Programmed Amplitude/Pulse Width	2.50 V / 0.40 ms	2.50 V / 0.40 ms
Measured P/R Wave	2.1 mV	>20 mV
Programmed Sensitivity	0.30 mV	0.30 mV

OBSERVATIONS (4)

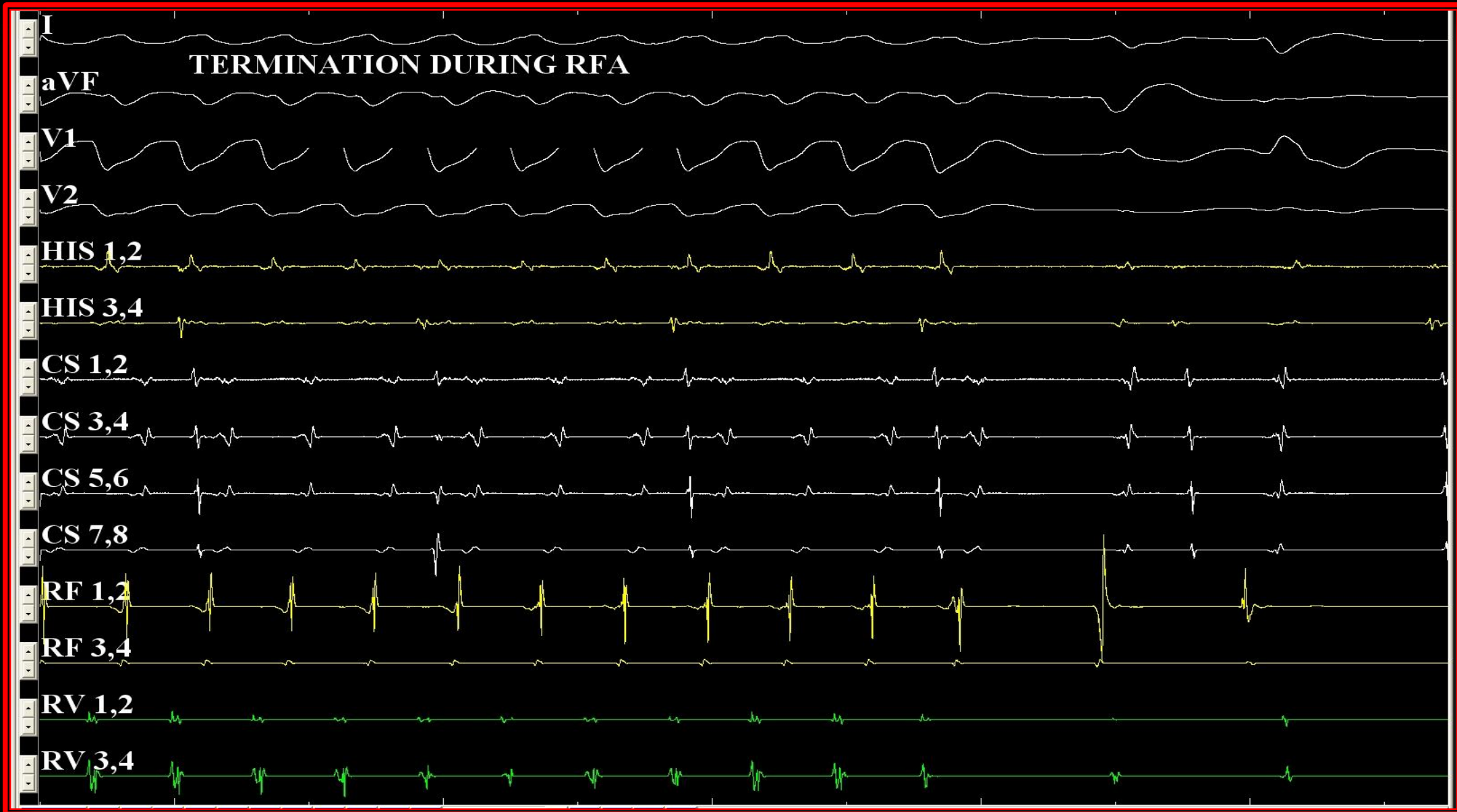
- RRT (02-Nov-2017): **REPLACE DEVICE.** Less than 3 months to EOS.
- Alert: RRT, battery voltage low.
- Patient Activity less than 1 hr/day for 1 weeks.
- VF detection may be delayed: VF Detection Interval is faster than 300 ms (200 bpm).



Scar Map



Termination during RFA



Remote Monitoring Data: 14/12/17

1 month post procedure



Medtronic

Quick Look II

Device: Evera MRI™ S DR DDMC3D1

Serial Number: CWC601892S

Date of Interrogation: 14-Dec-2017 10:48:02

Patient: [REDACTED]

Physician: Dr.Ulhas Pandurangi
044-26565961

Device Status (Implanted: 20-Nov-2017)

Remaining Longevity **11.0 years** (14-Dec-2017)



Clinical Status

Since 25-Nov-2017

Cardiac Compass Trends (Nov-2017 to Dec-2017)

Treated

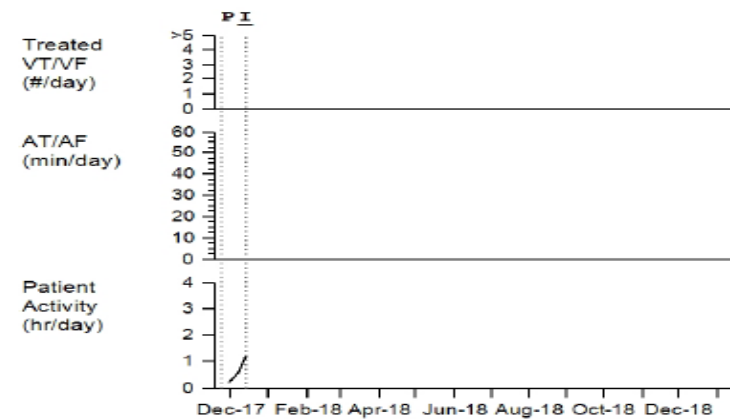
VF	0
FVT (Off)	
VT	0
AT/AF(Monitor)	

Monitored

VT (133-162 bpm)	0
VT-NS (>4 beats, >162 bpm)	0
High Rate-NS	0
SVT: VT/VF Rx Withheld	0
V. Oversensing-TWave Rx Withheld	0
V. Oversensing-Noise Rx Withheld	0
AT/AF	0
Time in AT/AF	0.0 hr/day (0.0%)

Functional

Patient Activity **Last Week**
1.3 hr/day



Therapy Summary

	VT/VF	AT/AF	Pacing	(% of Time Since 25-Nov-2017)
Pace-Terminated Episodes	0	0	Total VP	0.1% (MVP Off)
Shock-Terminated Episodes	0	0	AS-VS	100.0%
Total Shocks	0	0	AS-VP	< 0.1%
Aborted Charges	0	0	AP-VS	0.0%
			AP-VP	0.0%

Case 4

41Y, F, RHD, AF,
Severe LV systolic dysfunction LVEF:32%

Post-MVR operative day 6

Patient had cardiac arrest shifted to ICU

VT Storm

MMM

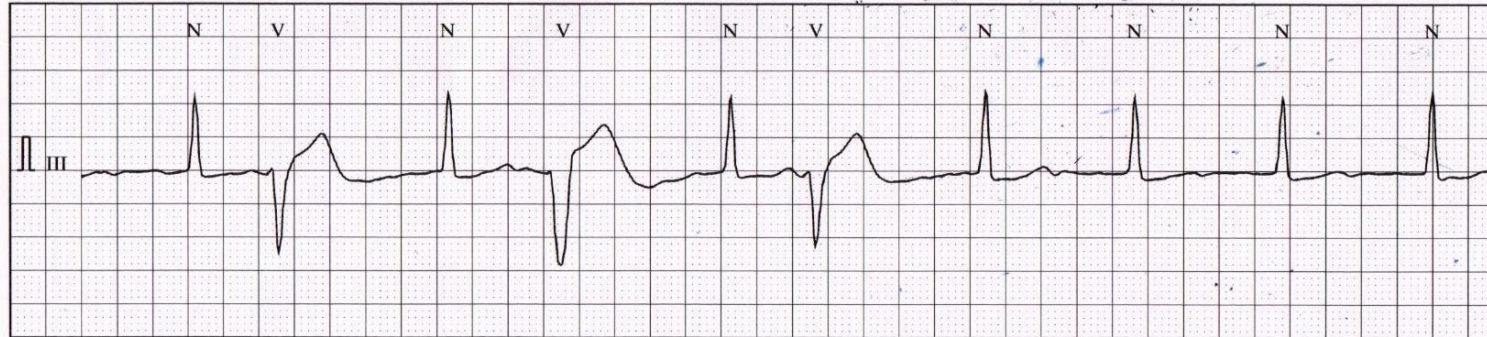
26-4-2018 17:16

Bed ID	ICU-001	Name		Gender	Not Specified	Patient ID	
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26-4-2018 16:38:45

BIGEMINY

25mm/s

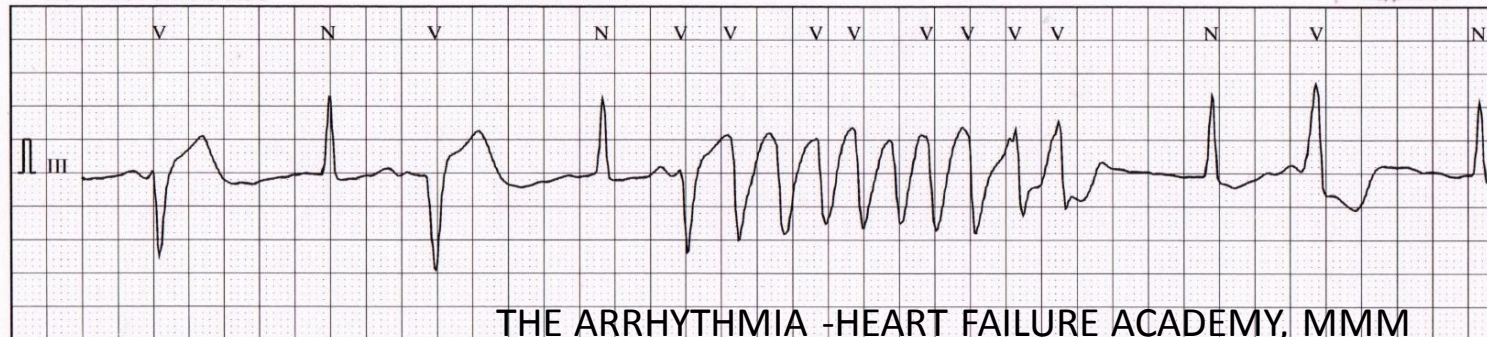


HR:80 PR:59
VPC:5 ST:-0.05mV
SpO₂:100
RR:21
T1:21.9
P1:114/46(68)
P2:7/1(4)

26-4-2018 16:38:55

VPC RUN

25mm/s



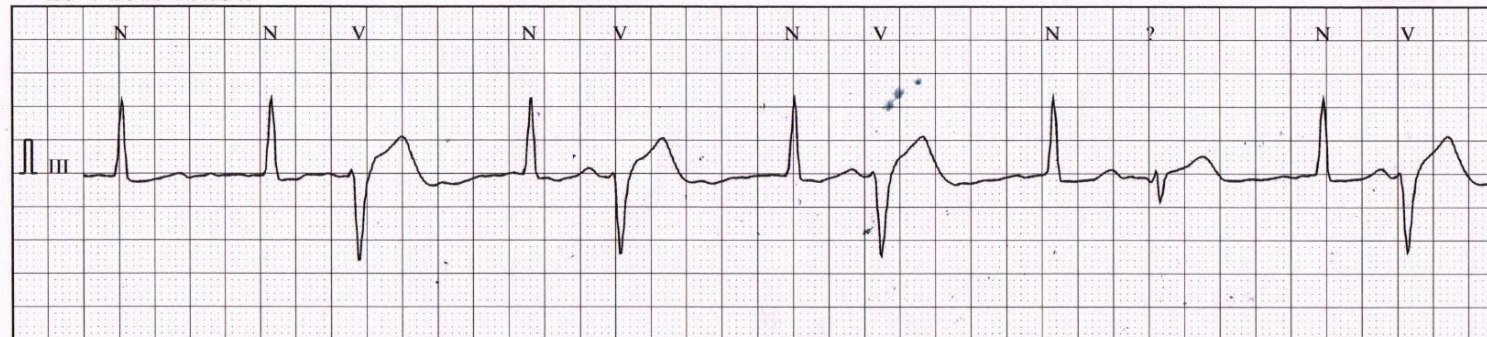
HR:130 PR:46
VPC:15 ST:-0.05mV
SpO₂:100
RR:21
T1:21.9
P1:117/24(43)
P2:7/2(4)

THE ARRHYTHMIA -HEART FAILURE ACADEMY, MMM

26-4-2018 16:39:5

BIGEMINY

25mm/s



HR:79 PR:40
VPC:20 ST:-0.04mV
SpO₂:100
RR:21
T1:21.9
P1:107/41(59)
P2:6/2(4)

Management strategy

Serum Potassium and Magnesium corrected

Pt continued to have Polymorphic VT storm

Anti-arrhythmic drugs added

Discharged later with an ICD

CASE 5

58 Y, M, No co-morbidities

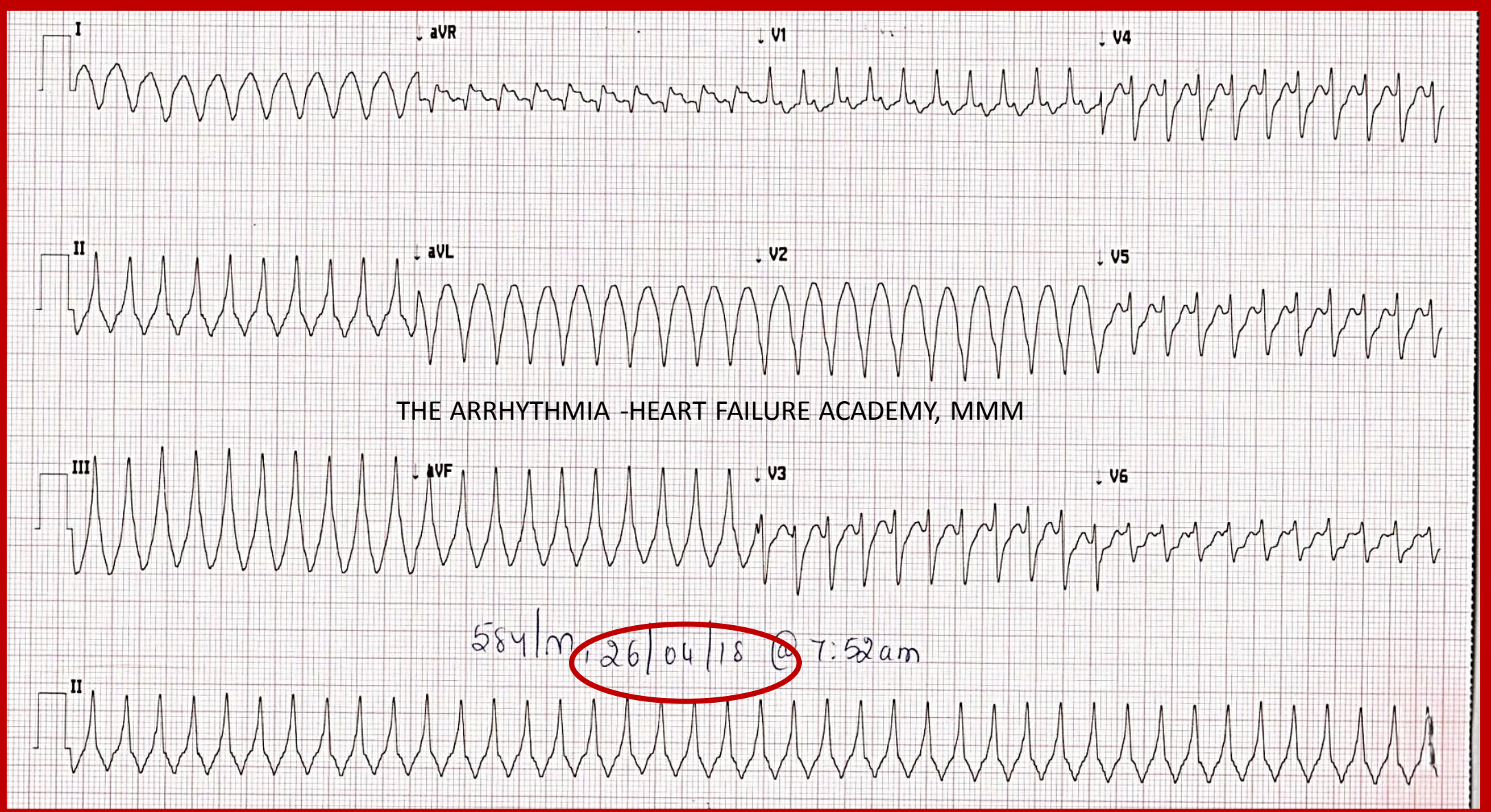
July 2018 → Presents to the ER with syncope

Diagnosed with VT → DC verted

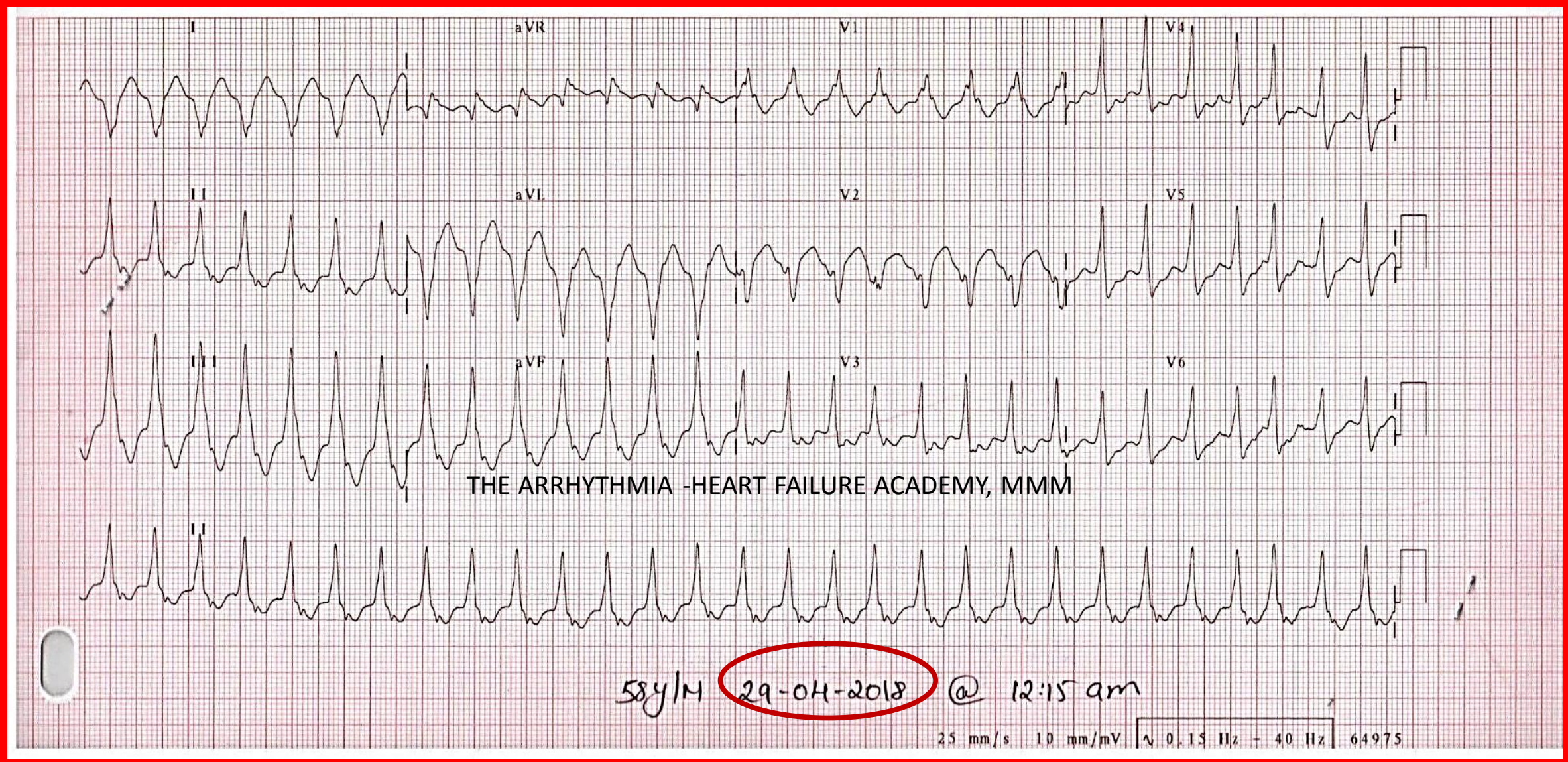
Recurrent episodes inspite of Cordarone + Lidocaine

Structurally normal heart (By ECHO), Normal coronaries

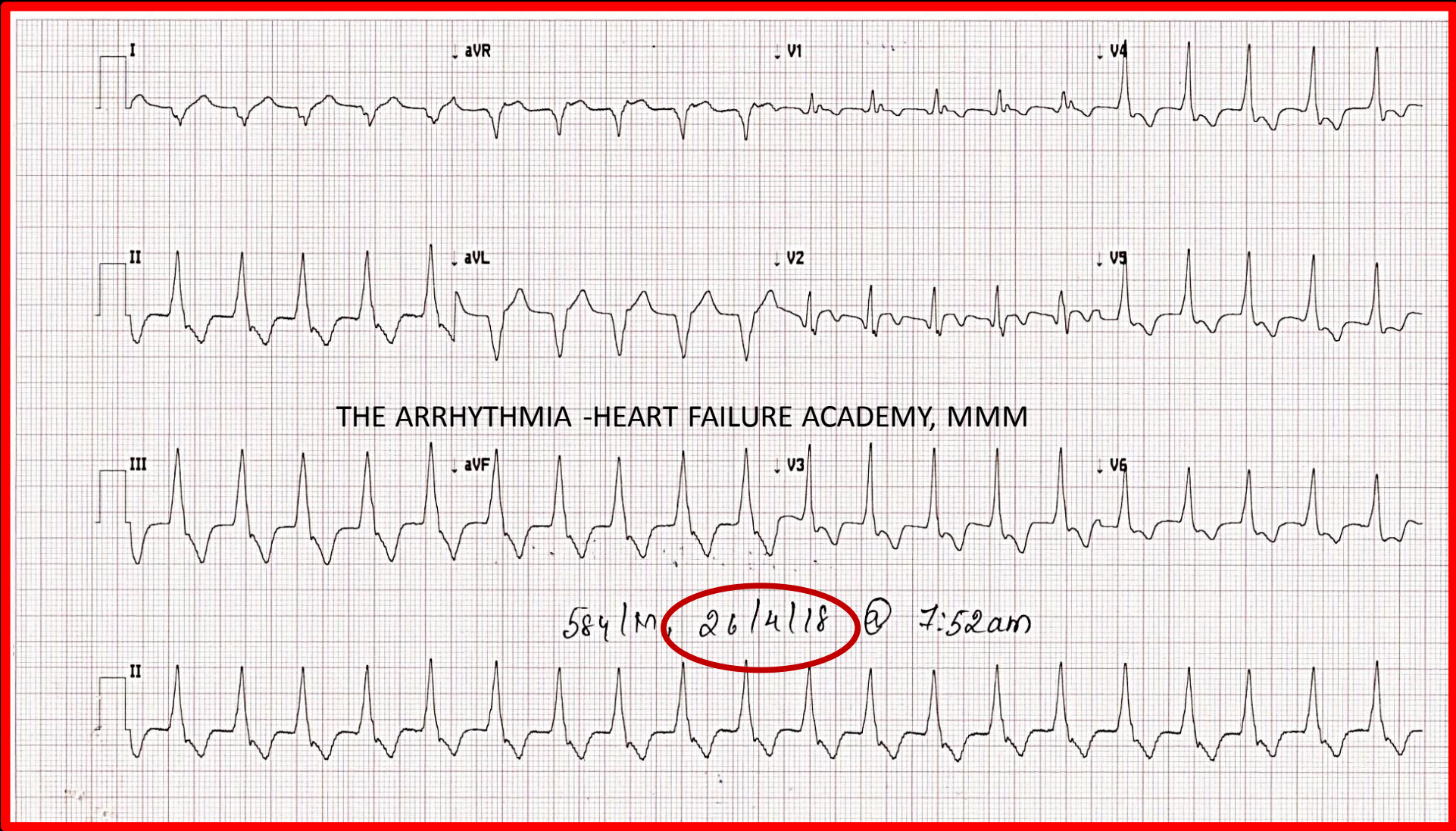
Fast VT



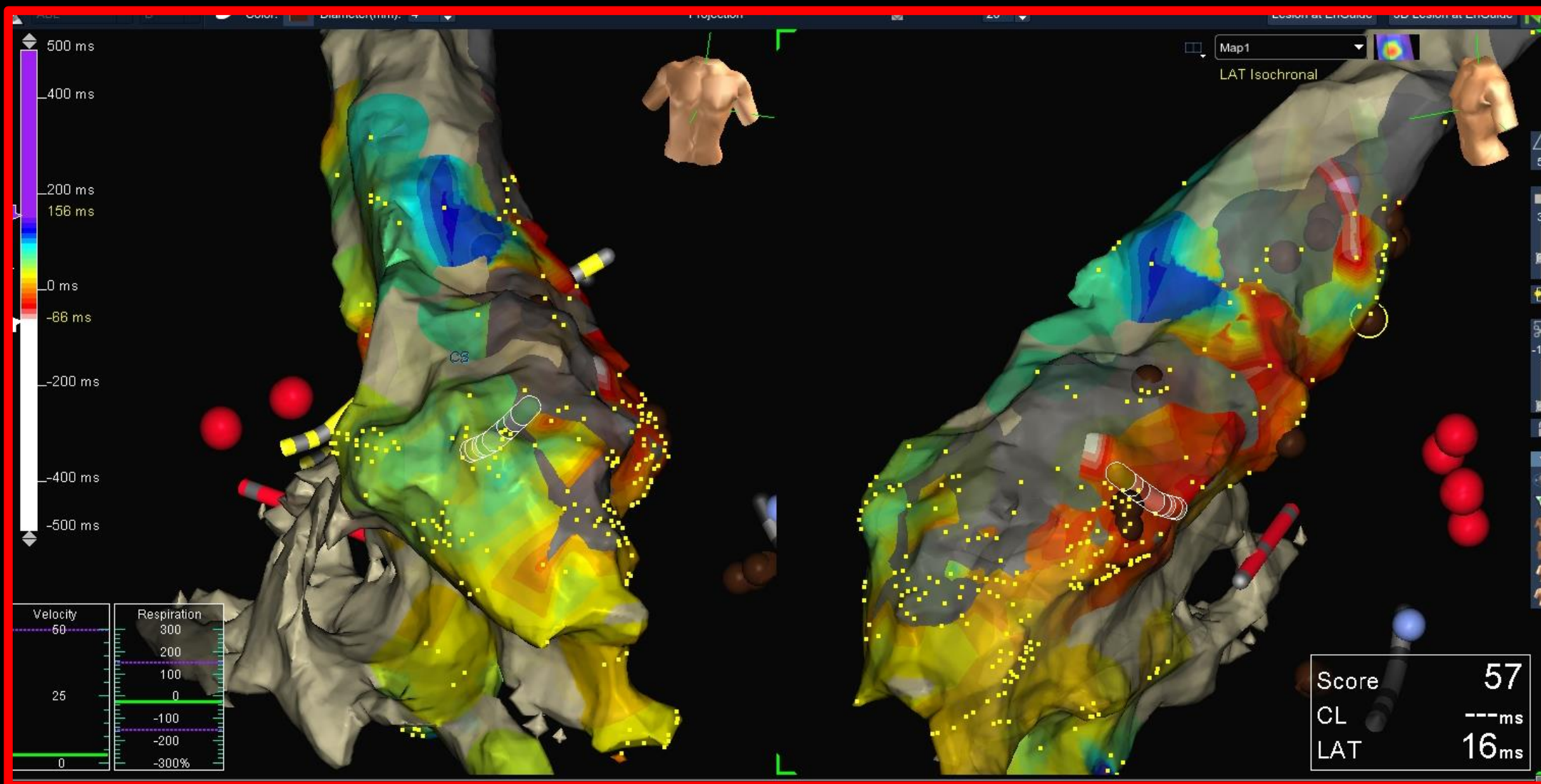
Fast VT



Slow VT

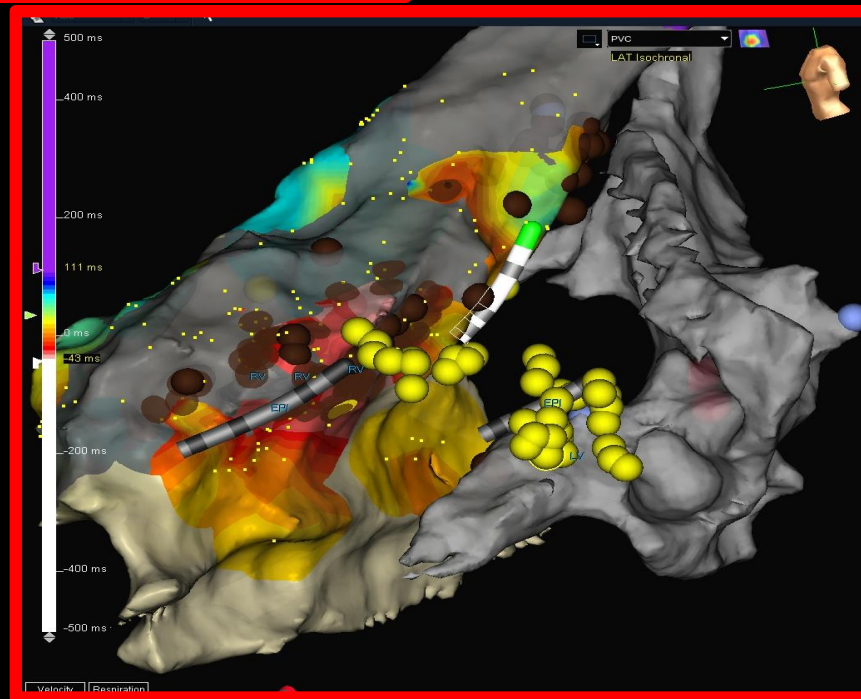
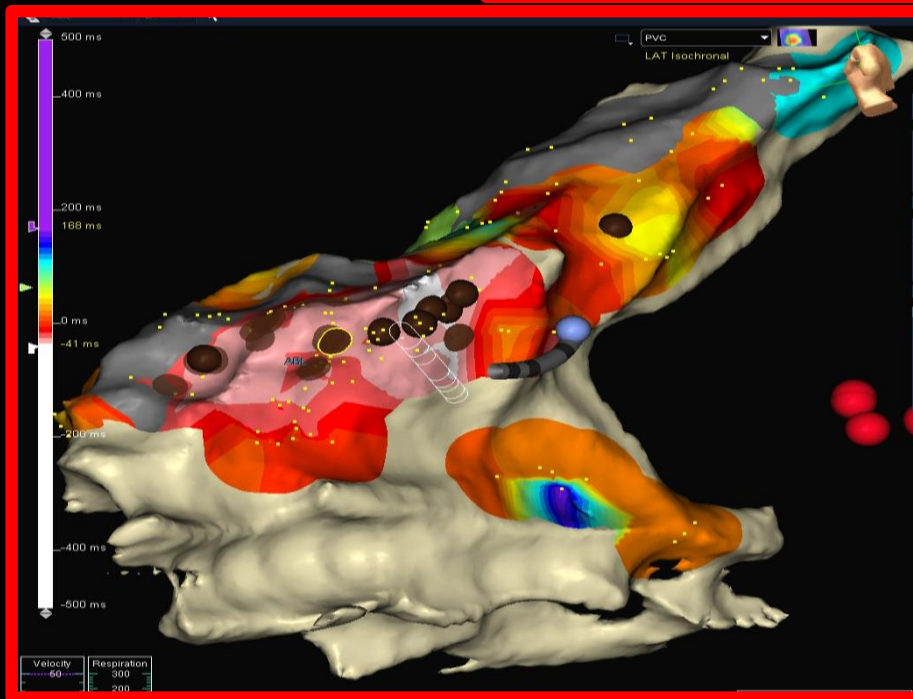
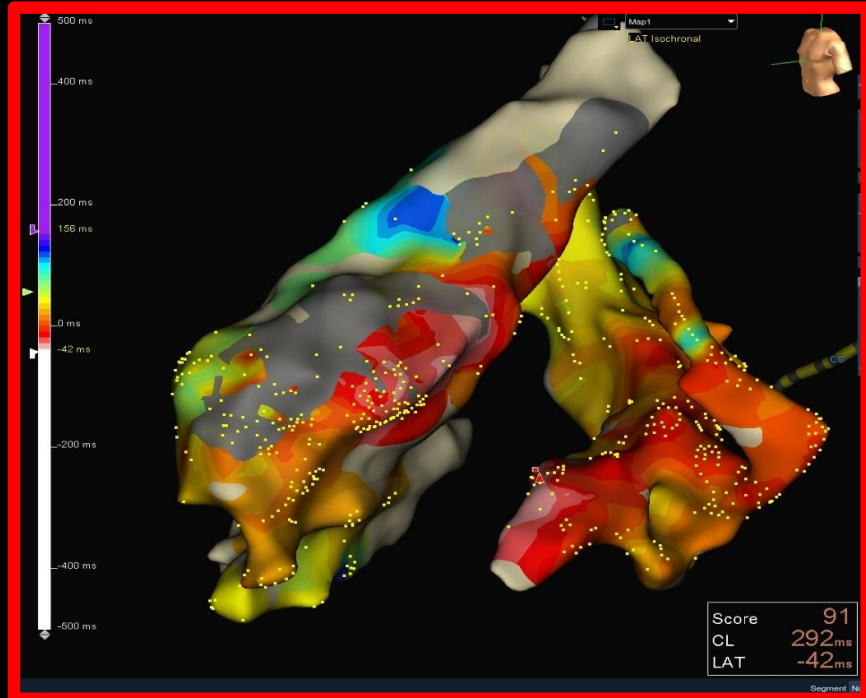


Endocardial VT ablation- RV septal scar +, VT persists



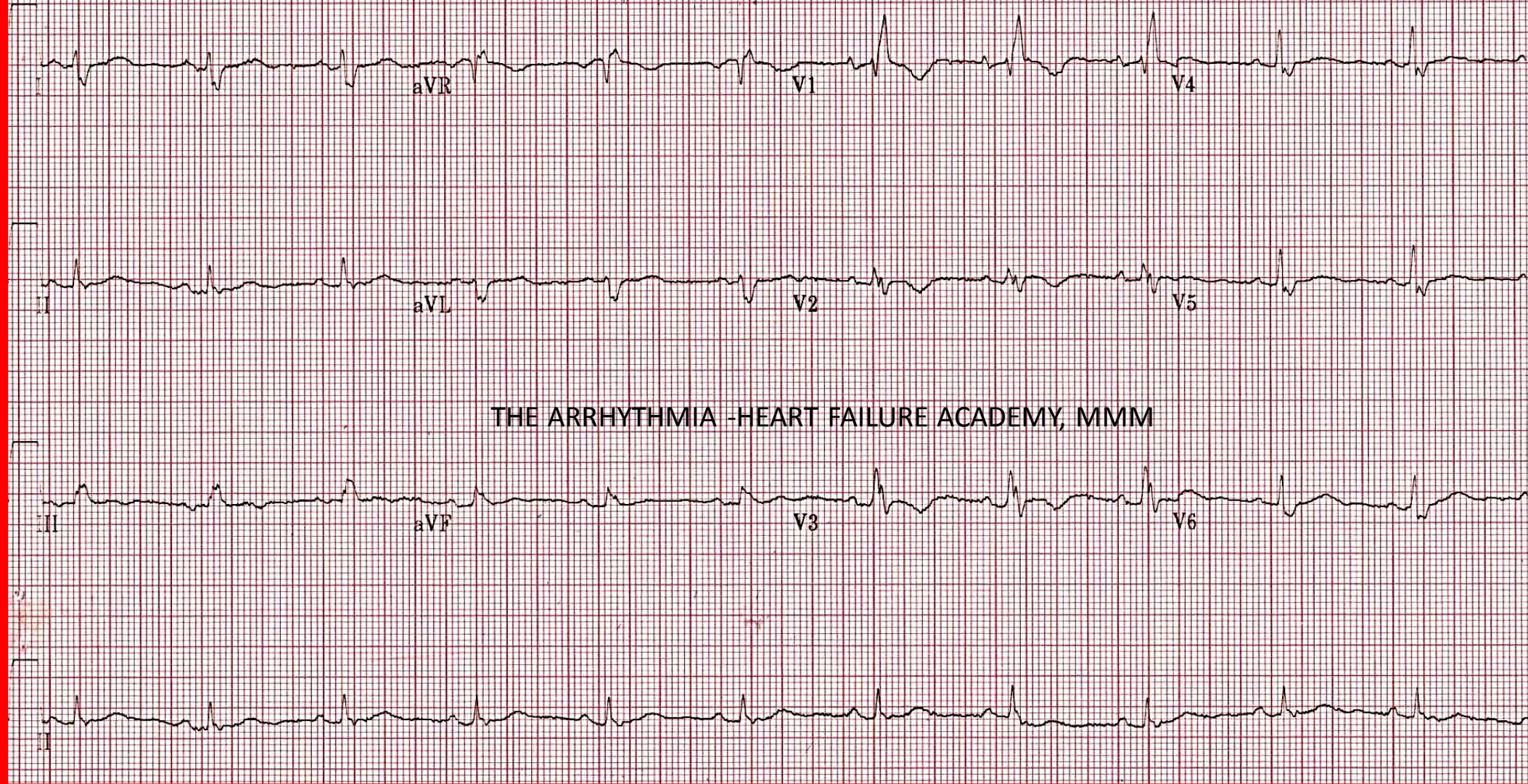
Epicardial VT ablation





Post RFA ECG

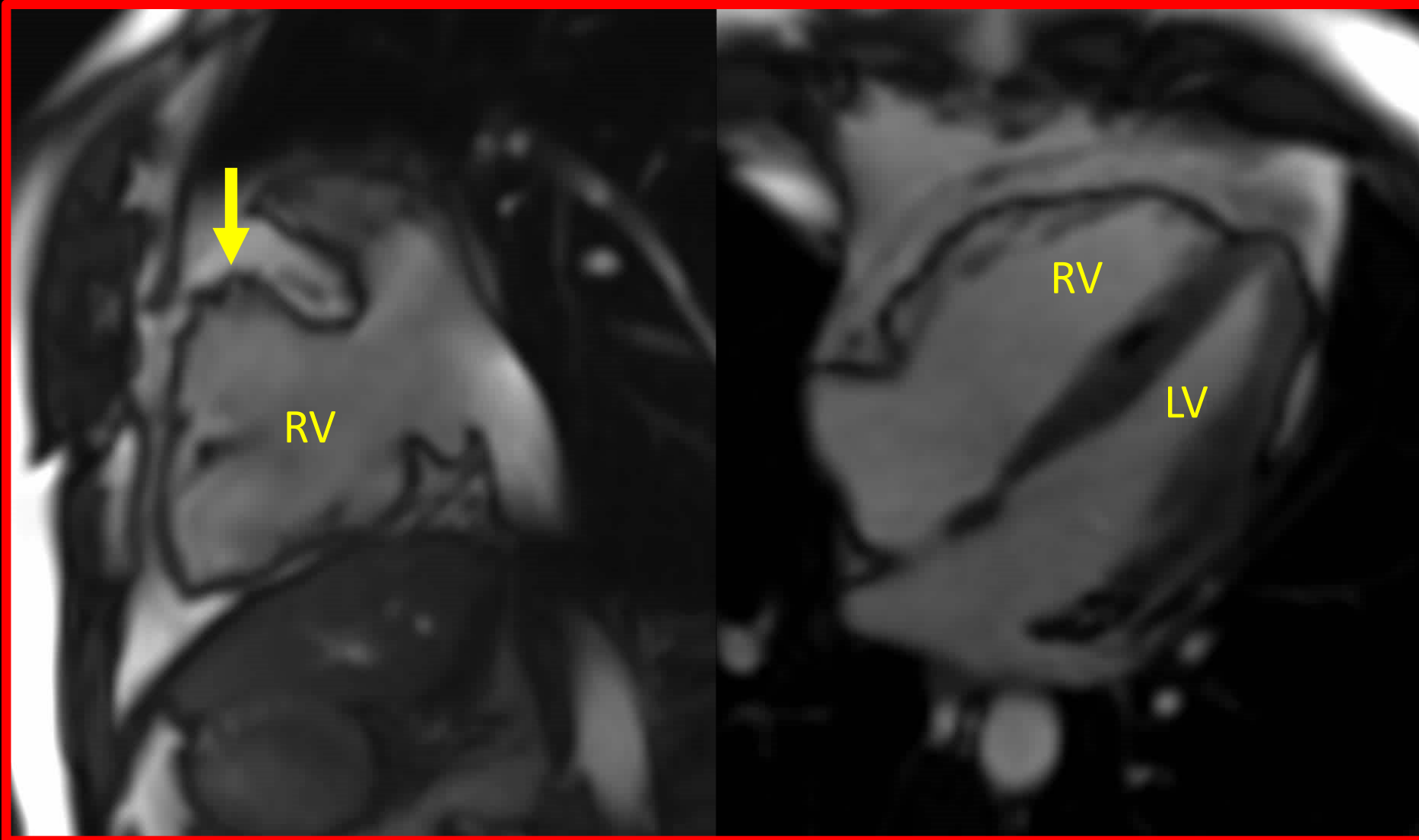
58y/M 22/7/18 @ 17:20



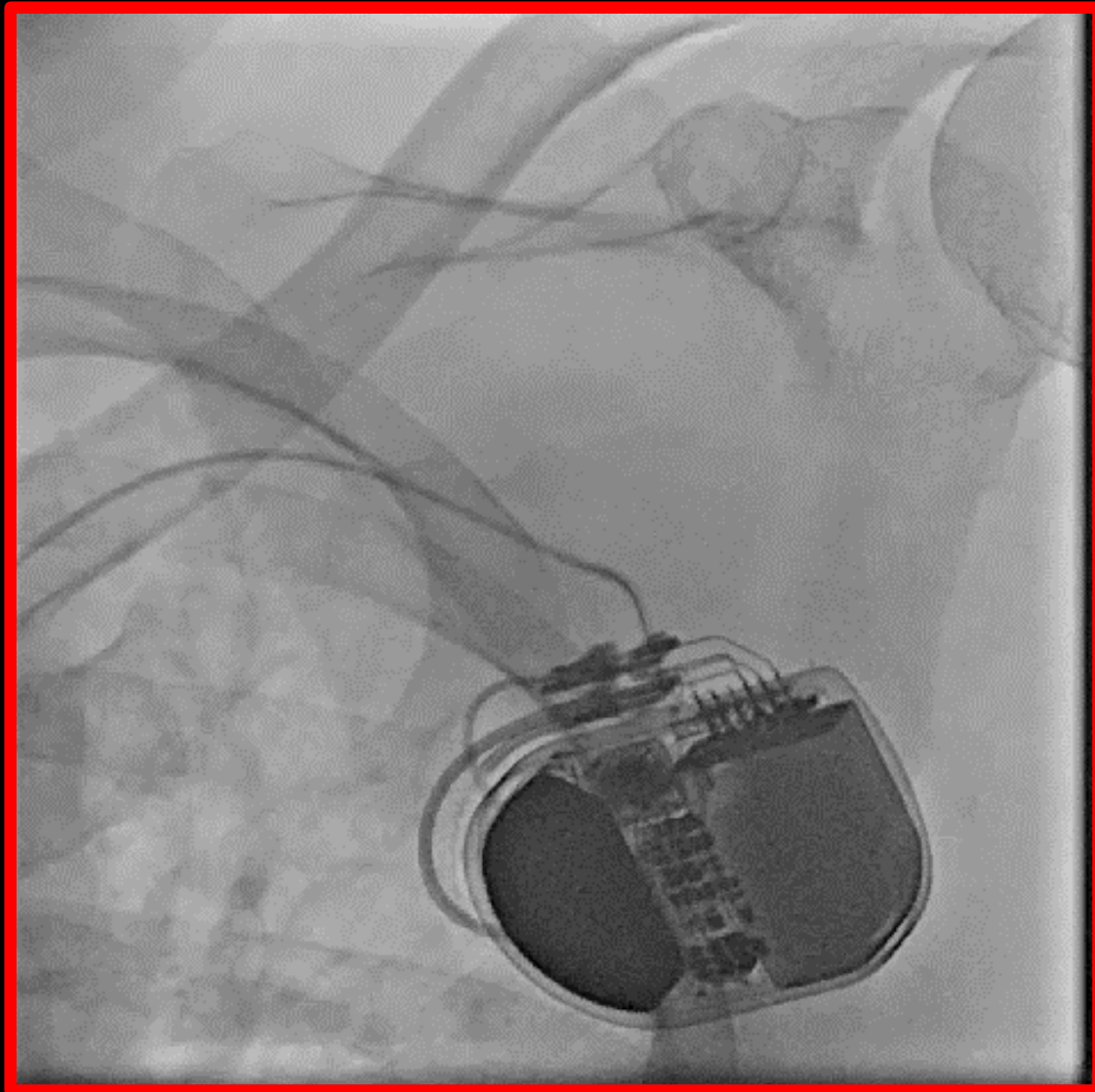
THE ARRHYTHMIA - HEART FAILURE ACADEMY, MMM

Suspicion of structural heart disease despite normal ECHO

MRI

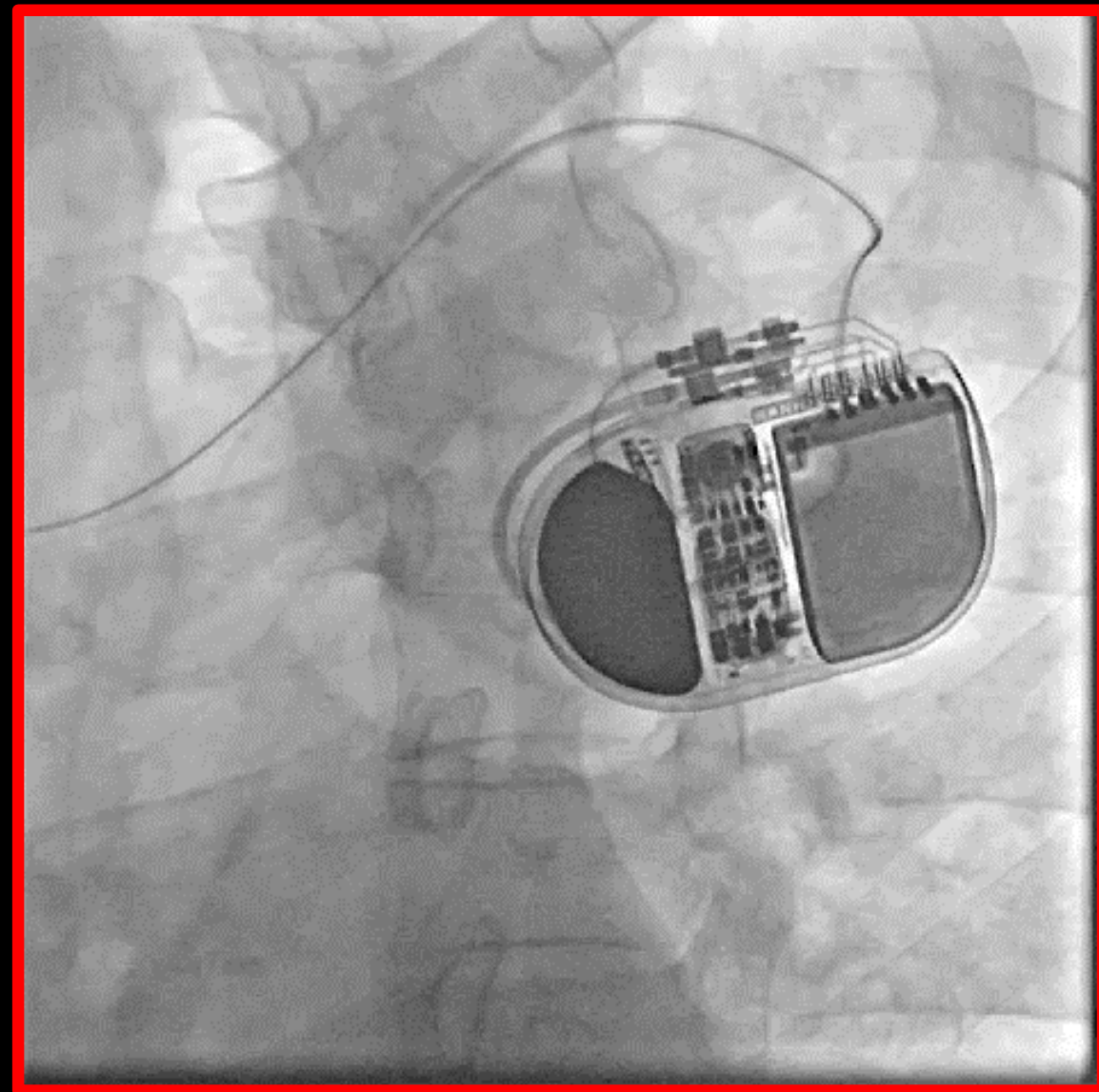


PA VIEW



AICD

LAO VIEW



Management of VT storm

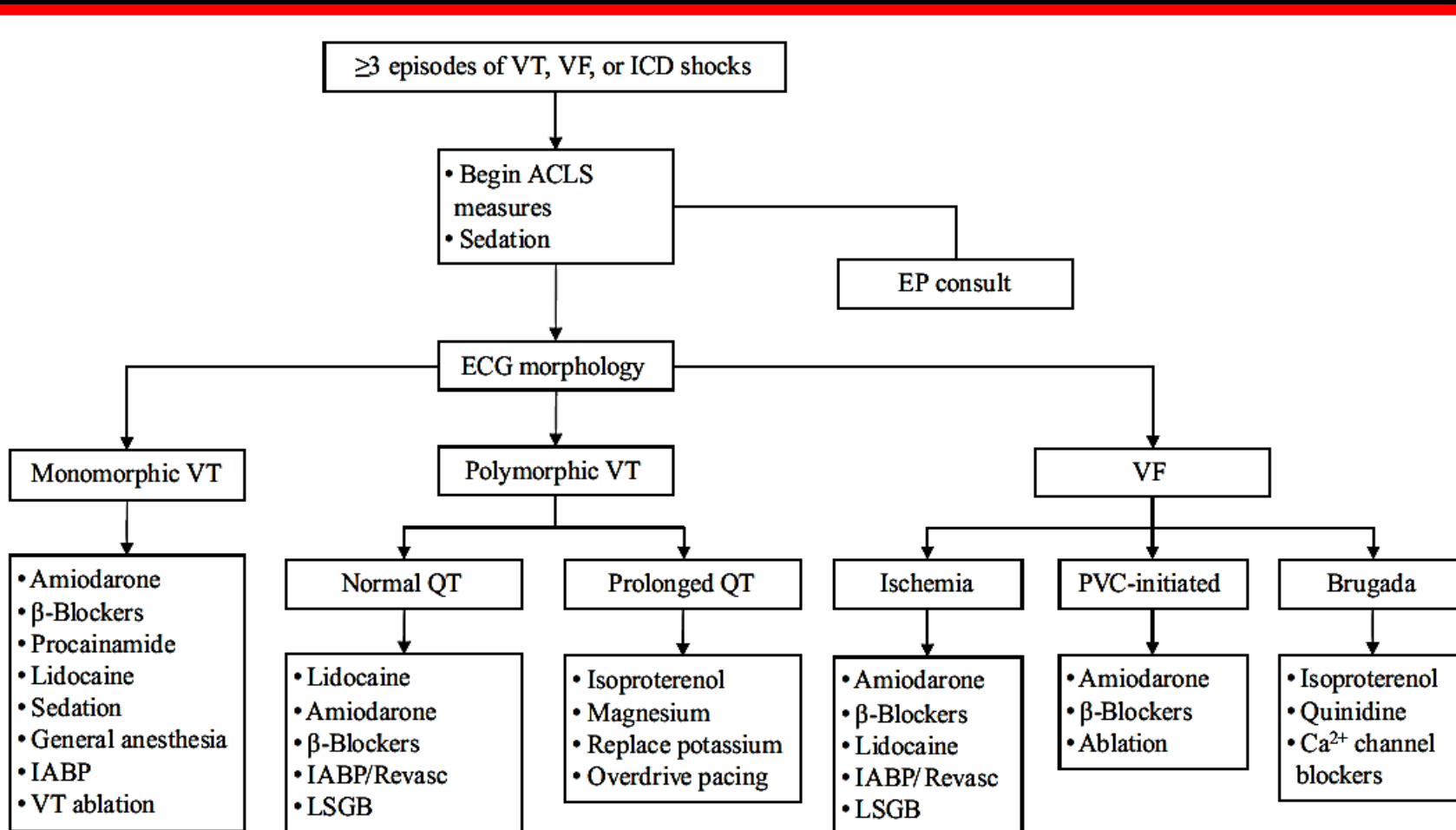


Fig. 1 Management of electrical storm.

ACLS = advanced cardiac life support; ECG = electrocardiographic; EP = electrophysiology; IABP = intra-aortic balloon pump; ICD = implantable cardioverter-defibrillator; LSGB = left stellate ganglion blockade; PVC = premature ventricular contraction; Revasc = revascularization; VF = ventricular fibrillation; VT = ventricular tachycardia

Take home messages

Emergency measures : Anti-arrhythmic therapy,
Stellate ganglion block

RFA – Crucial role in understanding mechanism of VT and
reduction of recurrence rates

ICD – For prevention of SCD

Received: 7 October 2018 | Revised: 11 December 2018 | Accepted: 19 December 2018

DOI: 10.1111/jce.13835

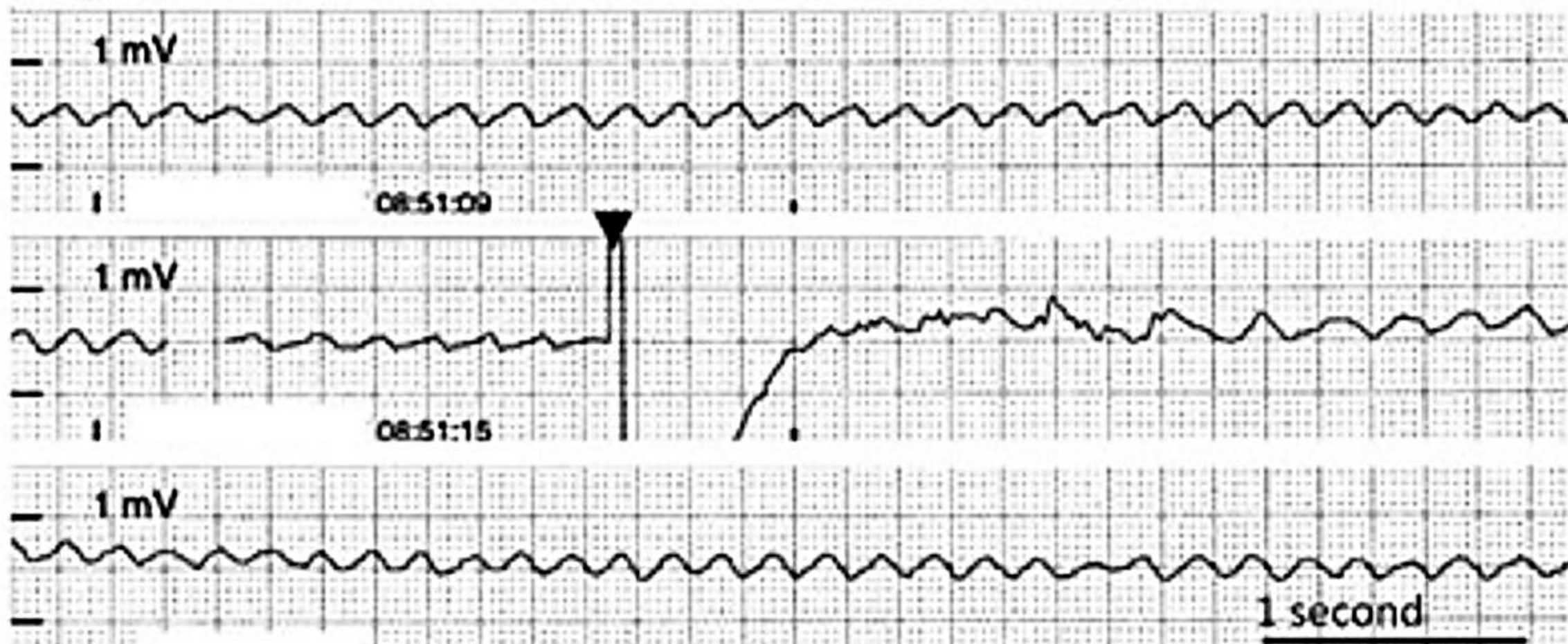
ORIGINAL ARTICLE

WILEY

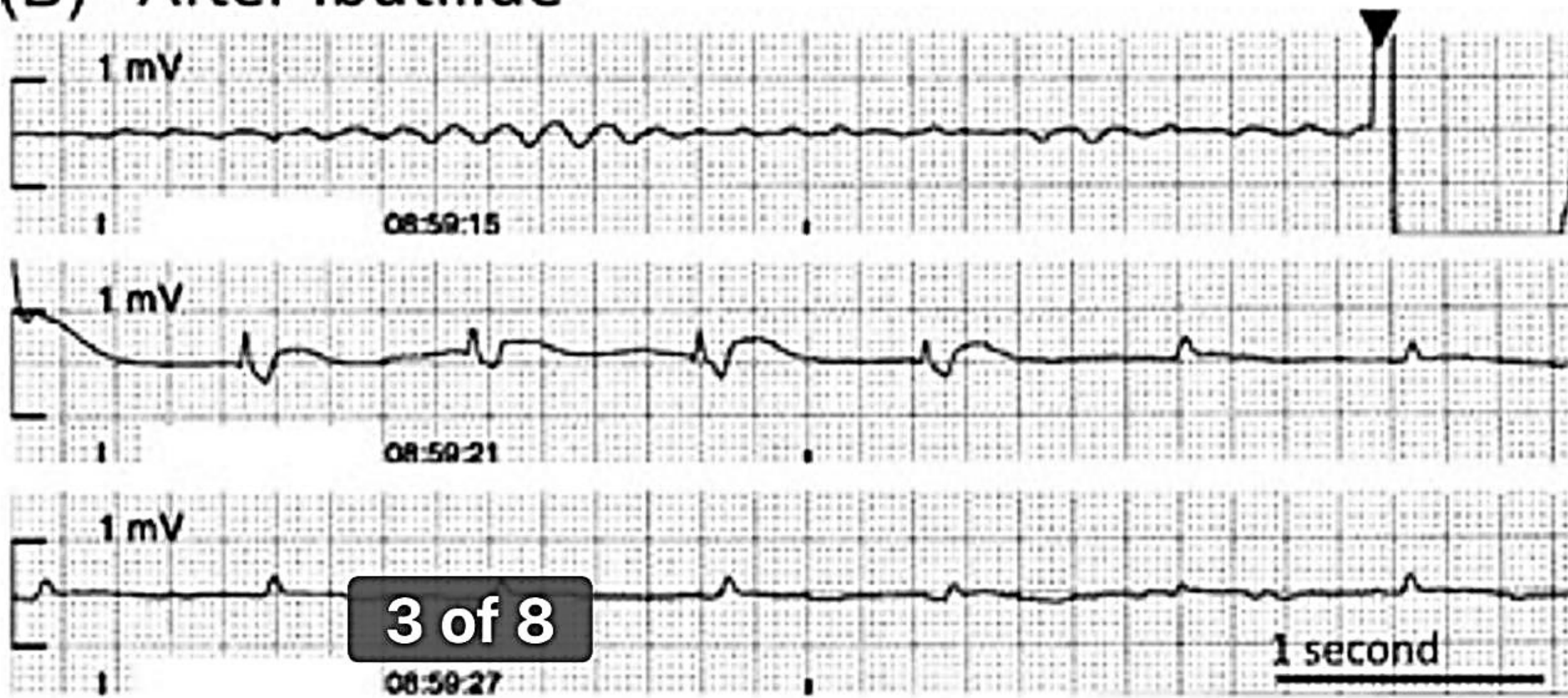
Ibutilide for the control of refractory ventricular tachycardia and ventricular fibrillation in patients with myocardial ischemia and hemodynamic instability

Mauricio Sendra-Ferrer MD  | Mario D. Gonzalez MD 

(A) - Before Ibutilide



(B) - After Ibutilide



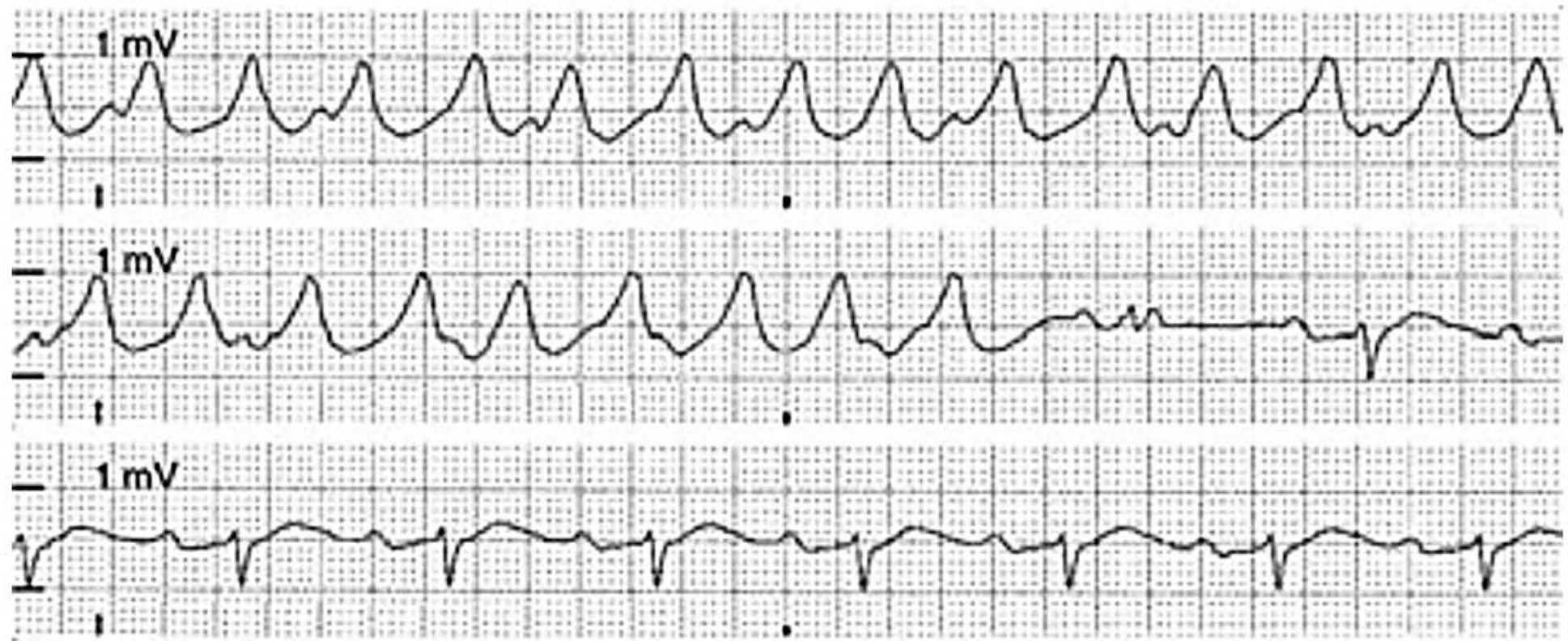


FIGURE 4 Termination of sustained ventricular tachycardia after ibutilide administration. Case 4. Following administration of ibutilide 1 mg intravenously, ventricular tachycardia terminated spontaneously

Under auspices of



1st World Congress on Cardiometabolic Medicine

| 27-28th April, 2019 Mumbai

THANK YOU

Dr. Ulhas M. Pandurangi MD., DM

Chief - Cardiac Electrophysiology & Pacing

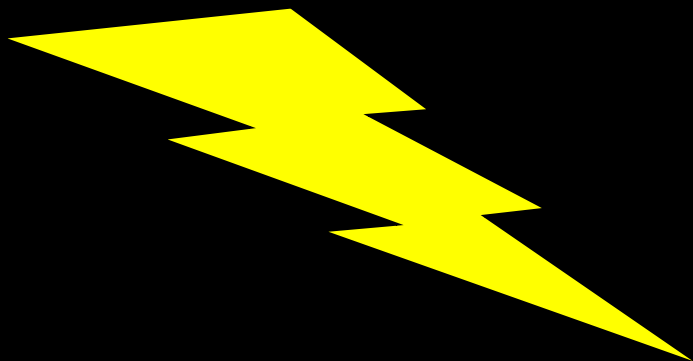
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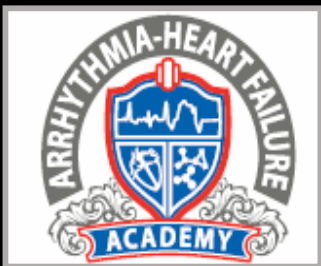
Founder President: Tamilnadu Electrophysiology Council

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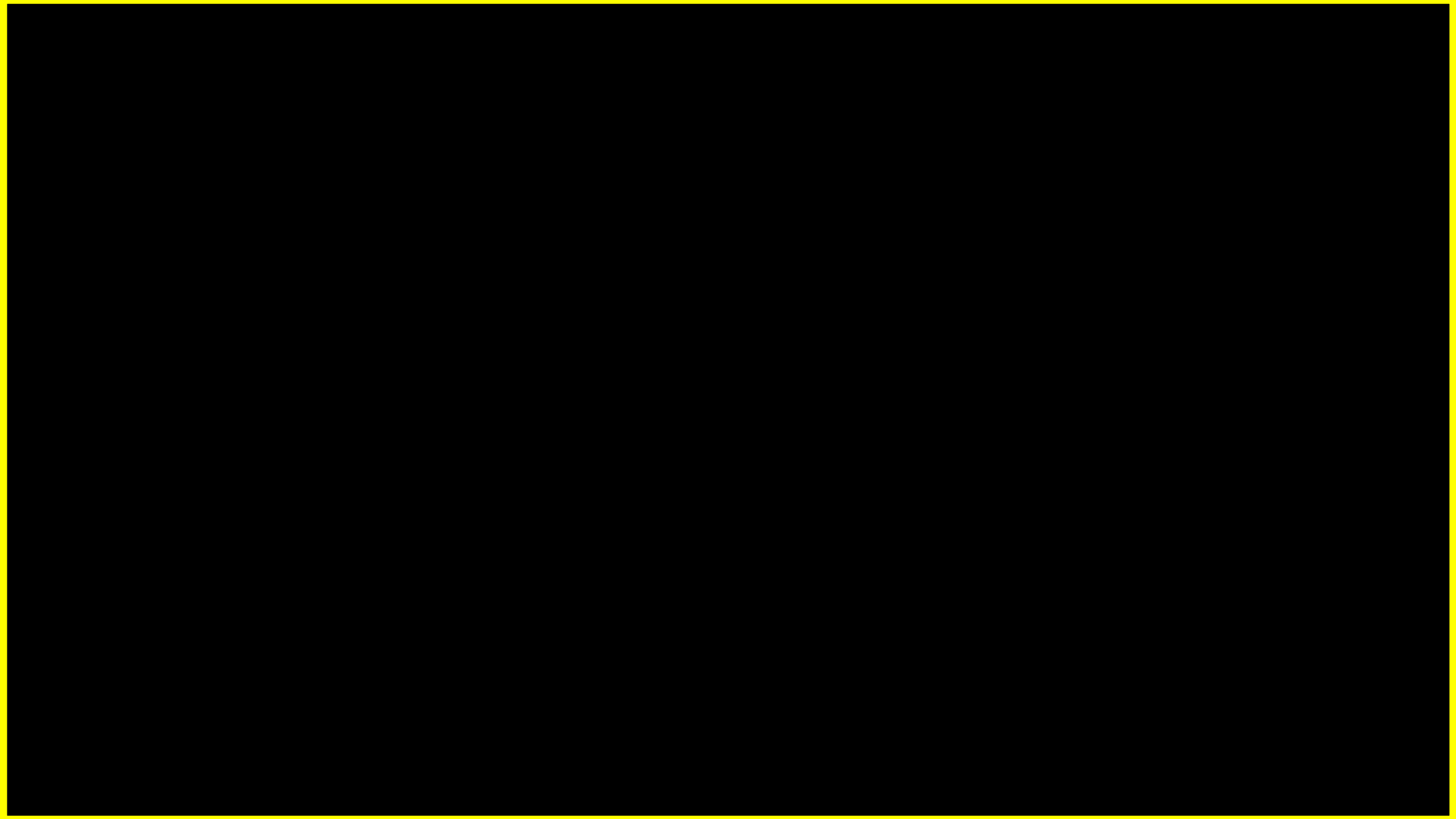


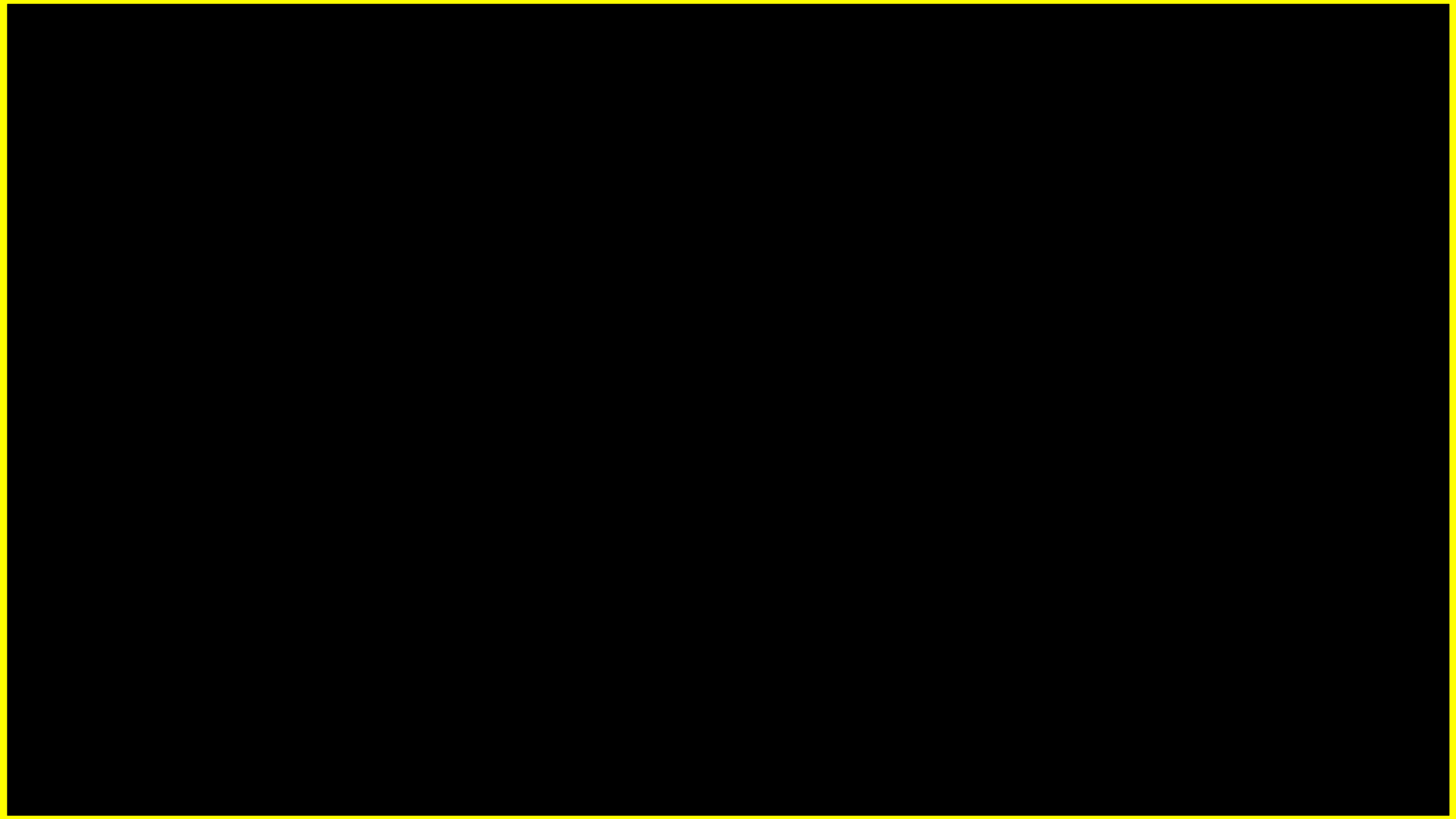


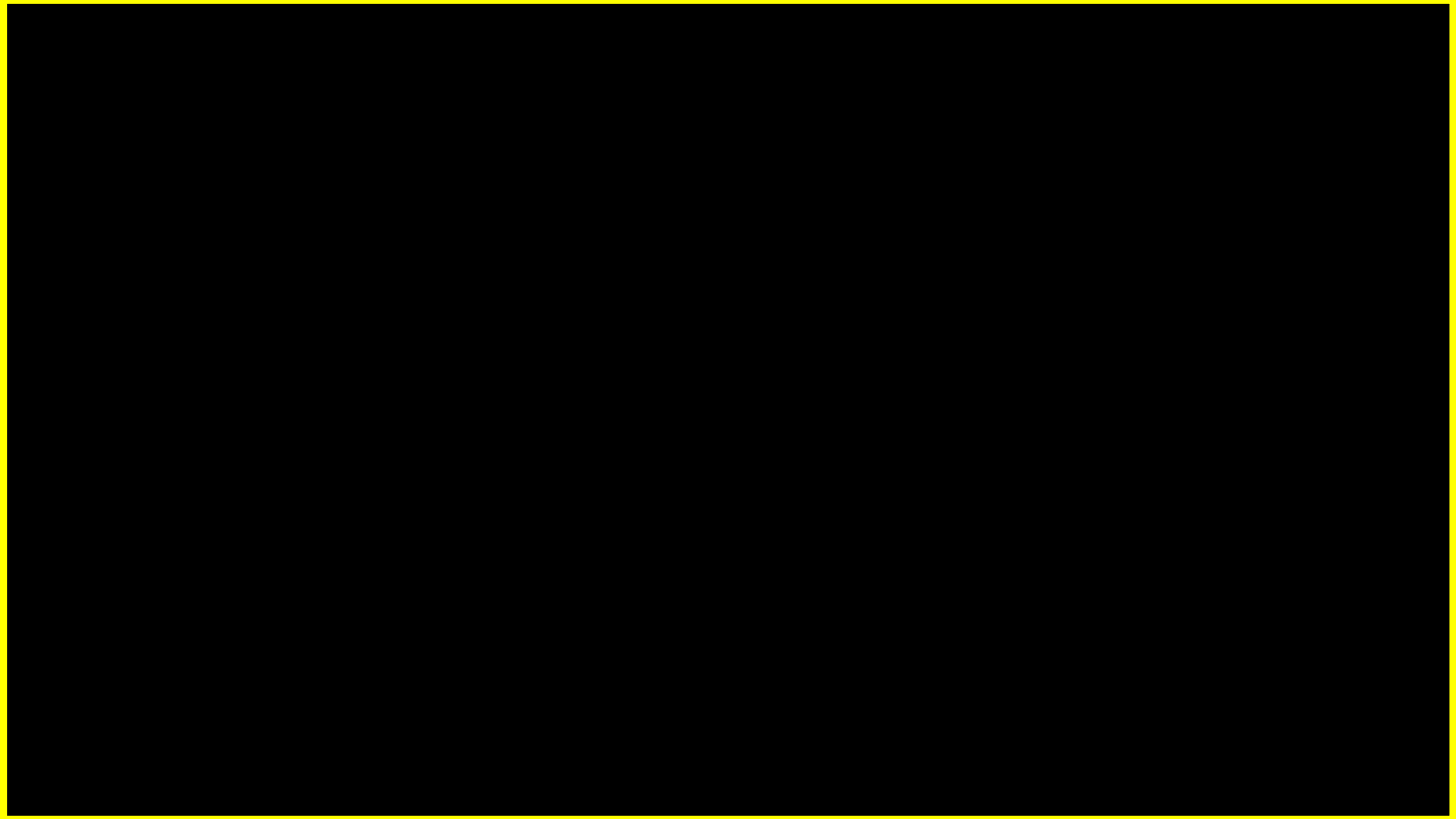


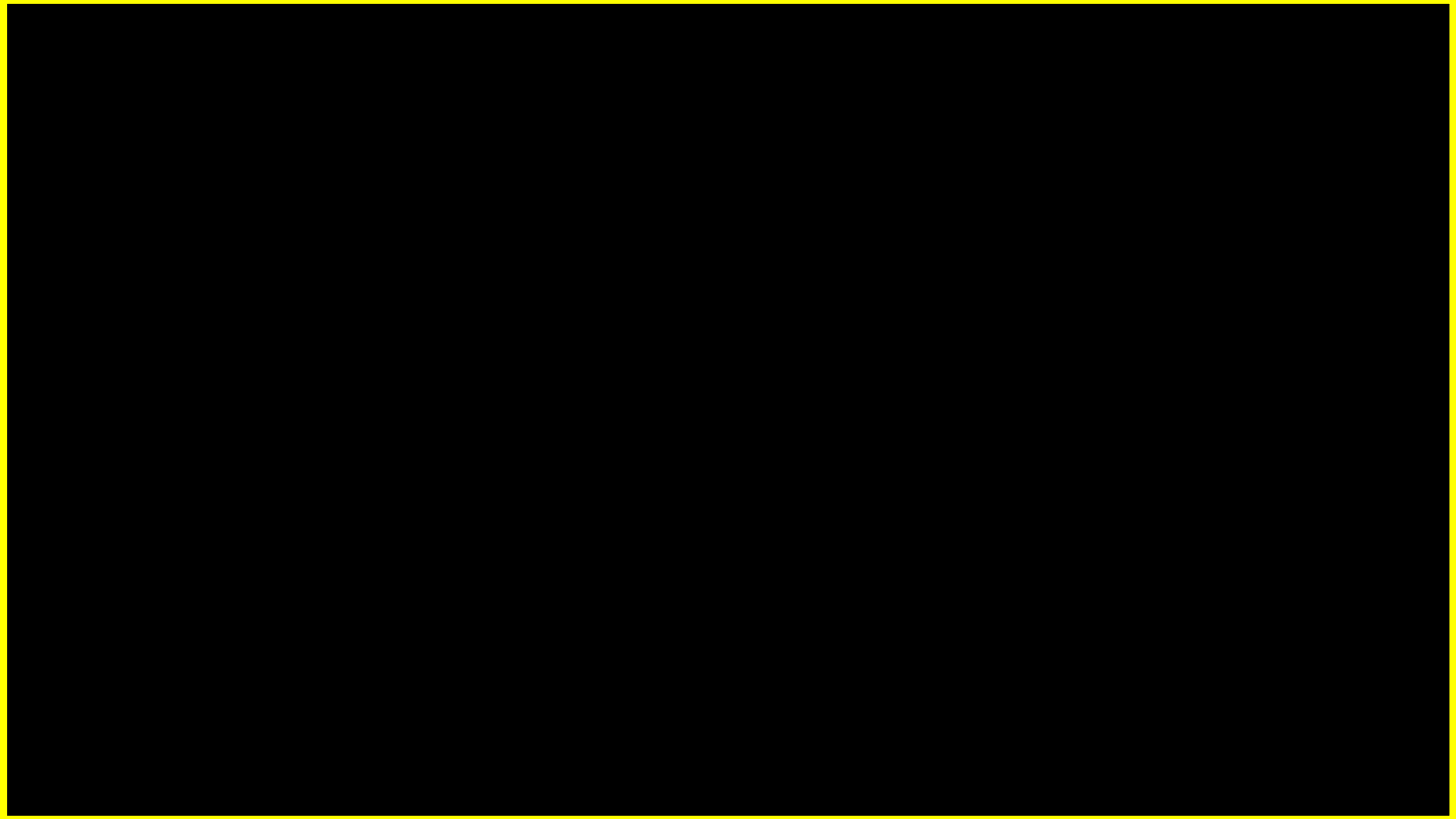












Thank you

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