Atrial Arrhythmia and Atrial Fibrillation Current Approach to Management

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Rabin Medical Center

Outline

- Brief Overview of Atrial Arrhythmia
- Definitions
- Diagnosis (ECG/EP)
- Medical Management
  - Anticoagulation
  - Rate vs. Rhythm Control
- Ablation

SVT- Narrow Complex Tachycardia

- AVNRT
- AVRT – Orthodromic (Antidromic)
- AT
  - (IAST, SAR)

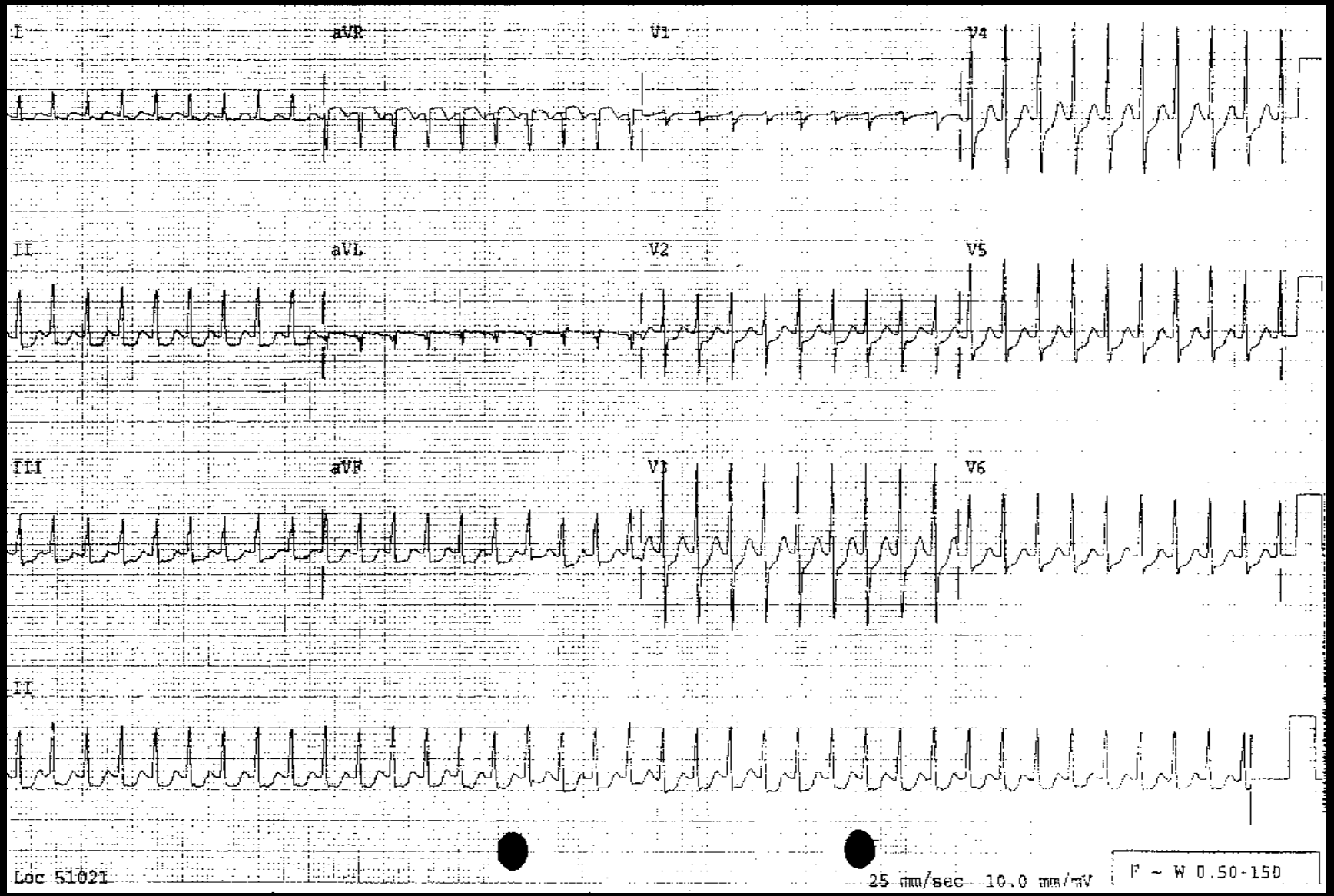
SVT- ECG Diagnosis

Short RP Tachycardia

- AVNRT
- Orthodromic AVRT
- Possible: AT with long PR

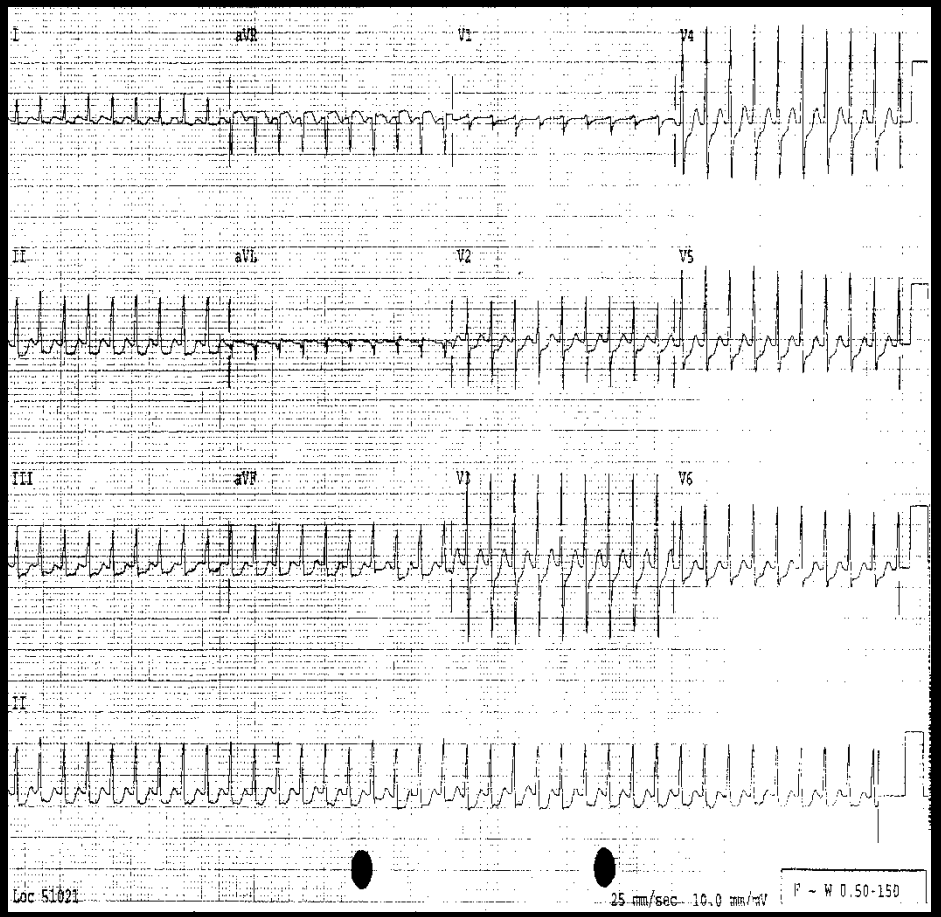
Long RP Tachycardia

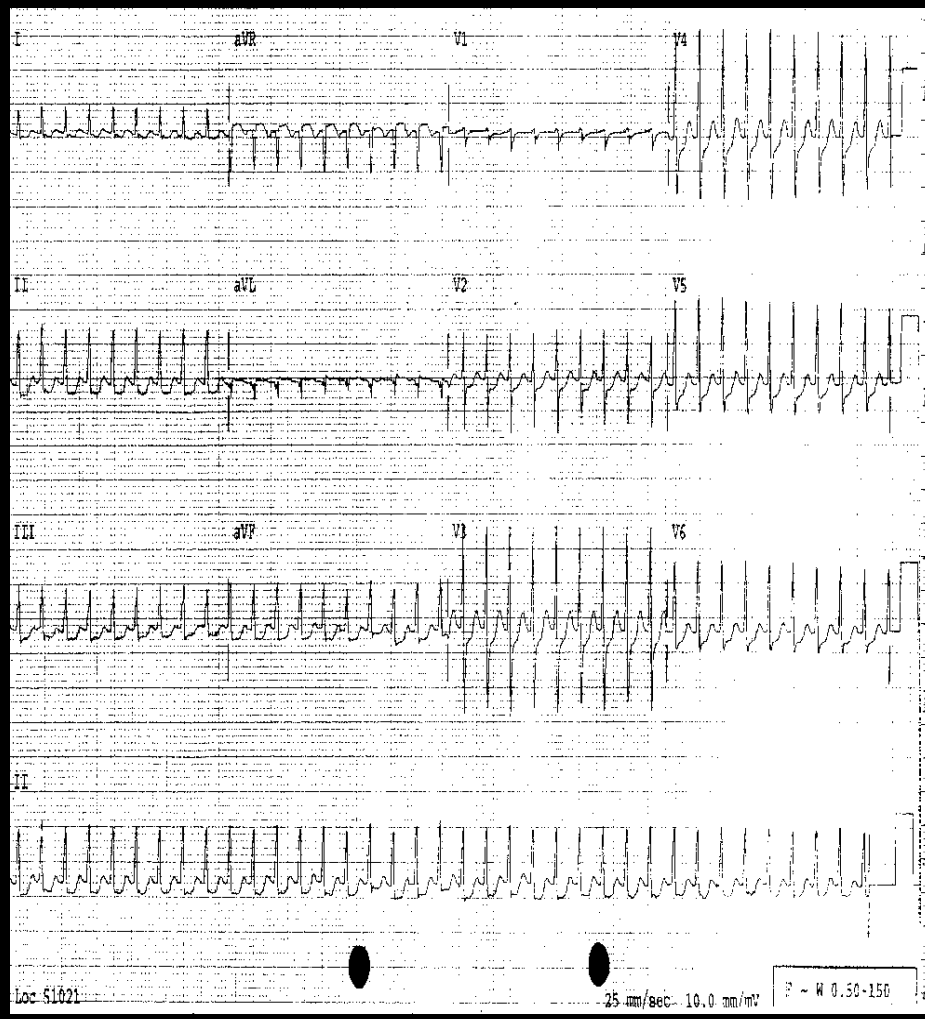
- AVNRT (typical with slowly conducting retrograde physiology or Atypical AVNRT: Fast-Slow or slow-slow
- AVRT (slow AP)
- AT

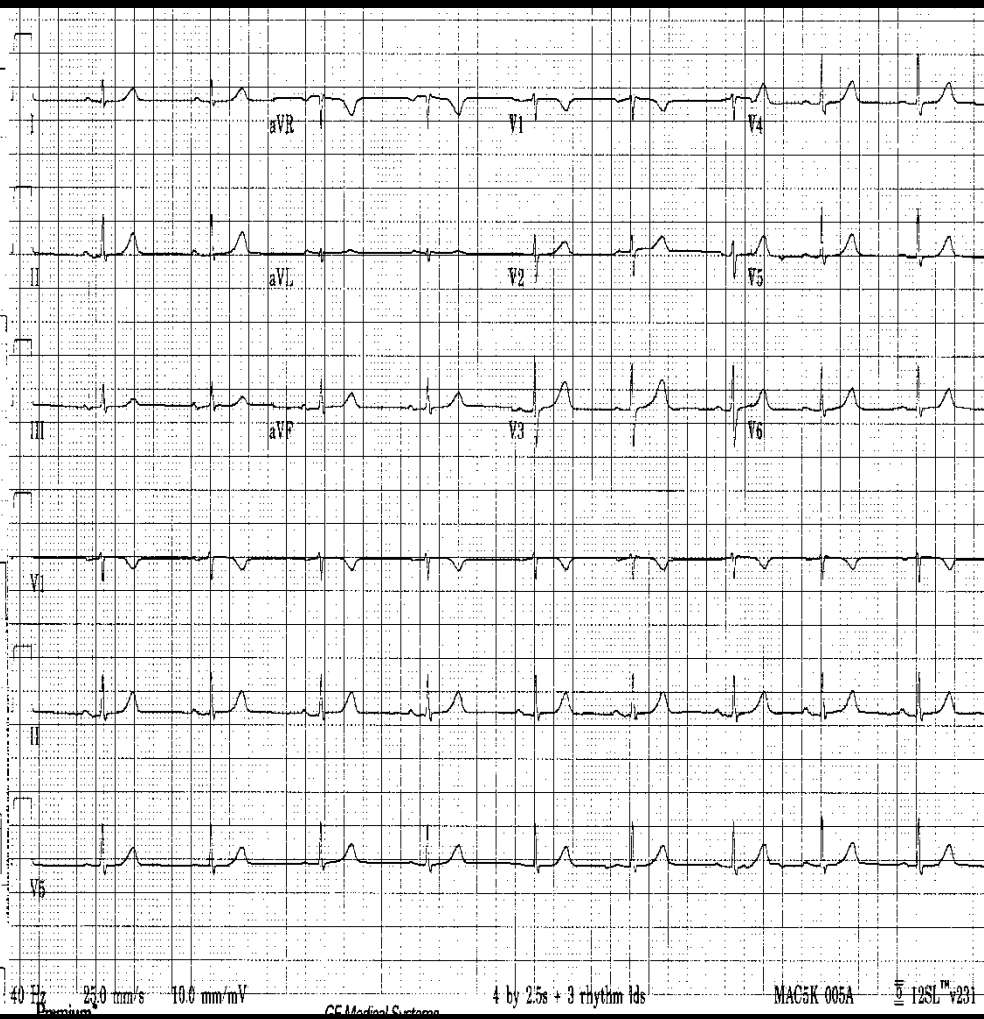

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Loc 51021
25 mm/sec 10.0 mm/mV
F ~ W 0.50-150

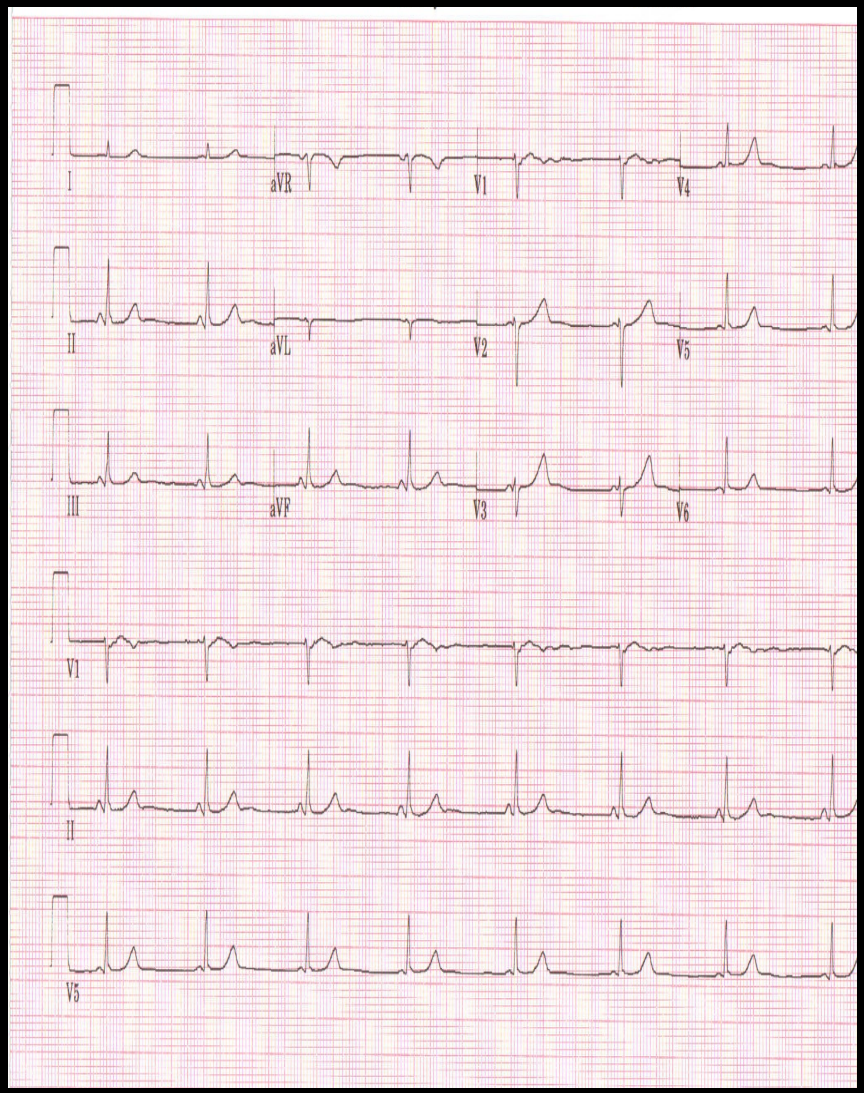
ECG -AVNRT

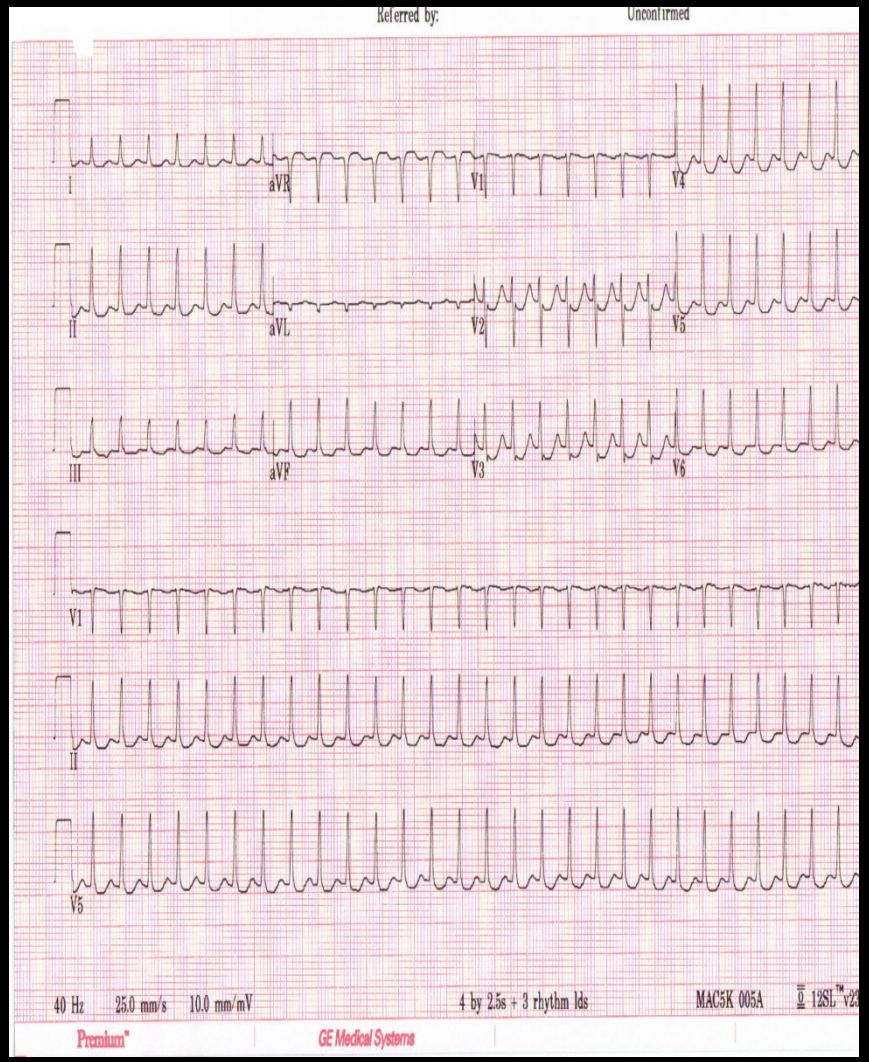
- RP<90 ms
- Usually RP<=0
- Pseudo S II, III, AVF
- Pseudo R V1 (avR)
- Pseudo Q
- AV or VA block
- P waves are midline and retrograde (p wave in II,III, avF)




I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Loc 51021
25 mm/sec 10.0 mm/mV
F ~ W 0.50-150
40 Hz


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
25.0 mm/s 10.0 mm/mV
4 by 2.5s + 3 rhythm lds
MAC5K 005A
12SL™ v231

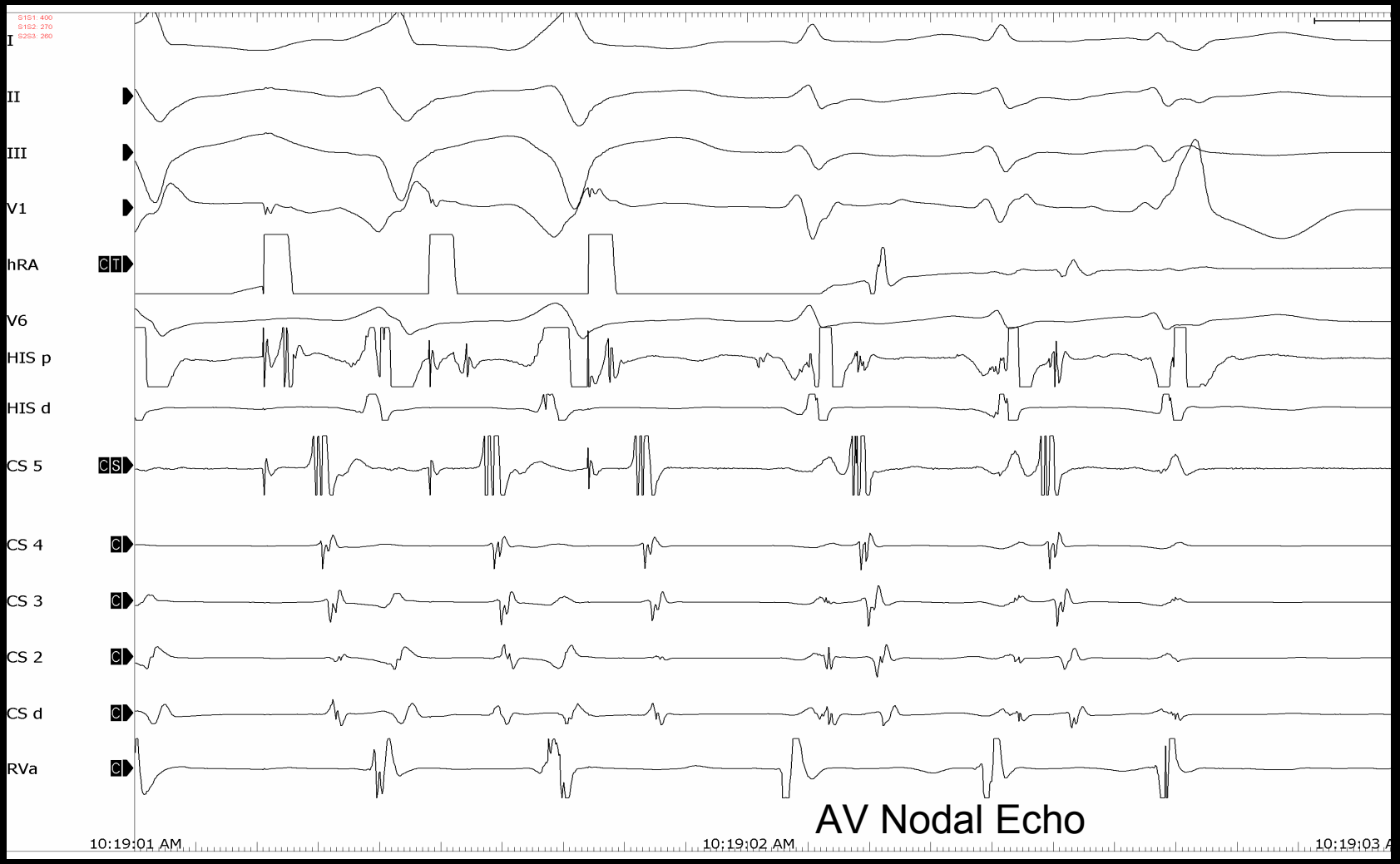

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5


Referred by:
Unconfirmed
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
40 Hz
25.0 mm/s
10.0 mm/mV
4 by 2.5s + 3 rhythm lds
MAC5K 005A
Premium
GE Medical Systems

AVNRT - EPS

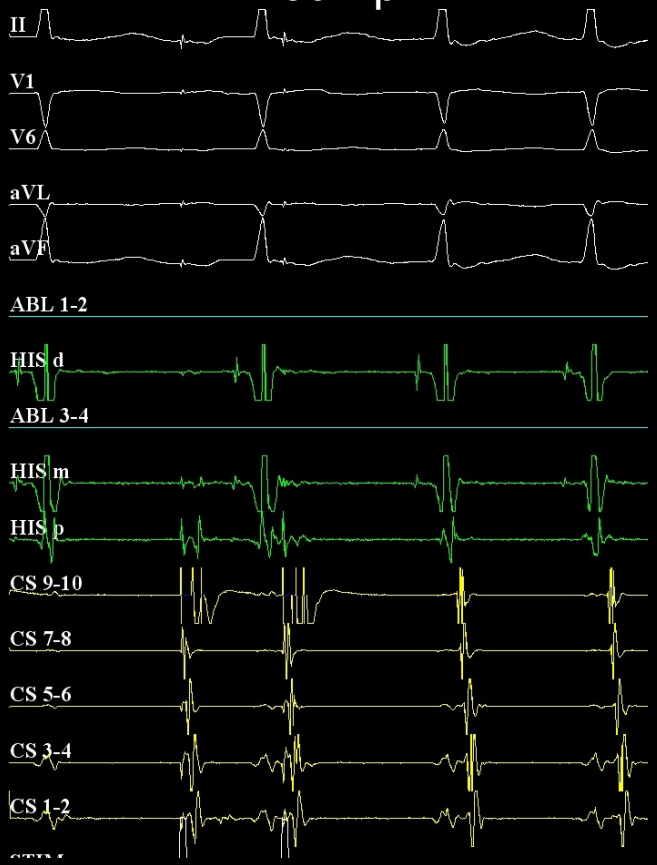
- Evidence of dual AVN physiology preferably with AH jump and AVN echoes
- Initiation always with AH delay
- VA<60 ms
- Concentric atrial activation with earliest A in HBE (Usually)
- On rare occasions AV block or VA block

AVNRT EPS


S1S1: 400
S1S2: 270
S2S3: 260
I
II
III
V1
hRA
CT
V6
HIS p
HIS d
CS 5
CS
CS 4
CS 3
CS 2
CS d
RVa
C
AV Nodal Echo
10:19:01 AM
10:19:02 AM
10:19:03 A

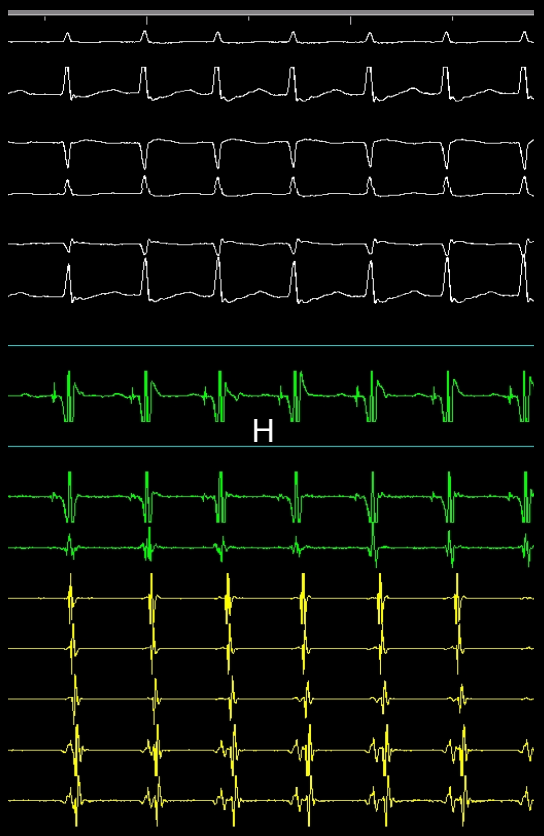
AVNRT EP

AH Jump

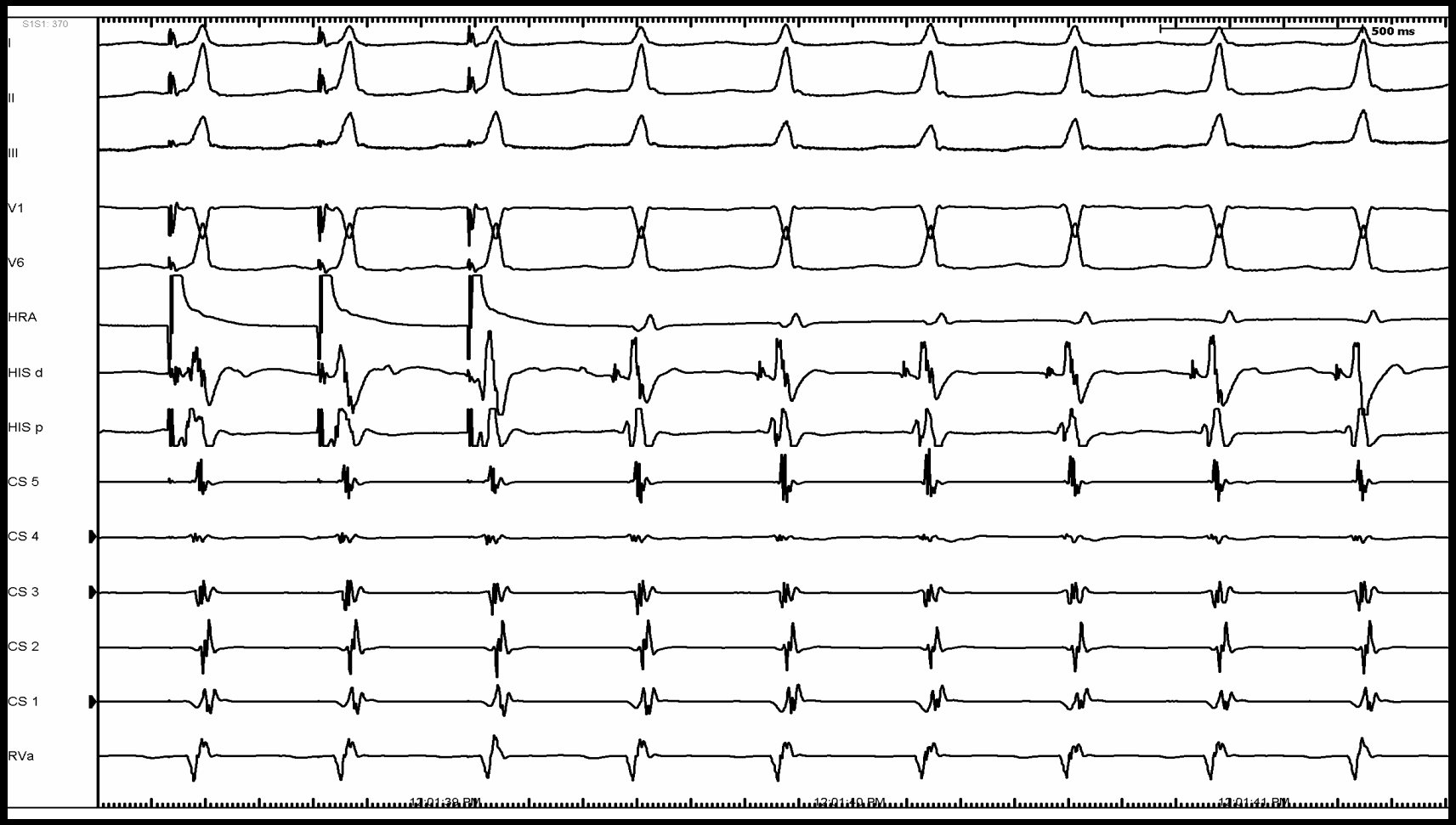


Pseudo S

Pseudo R



AVNRT

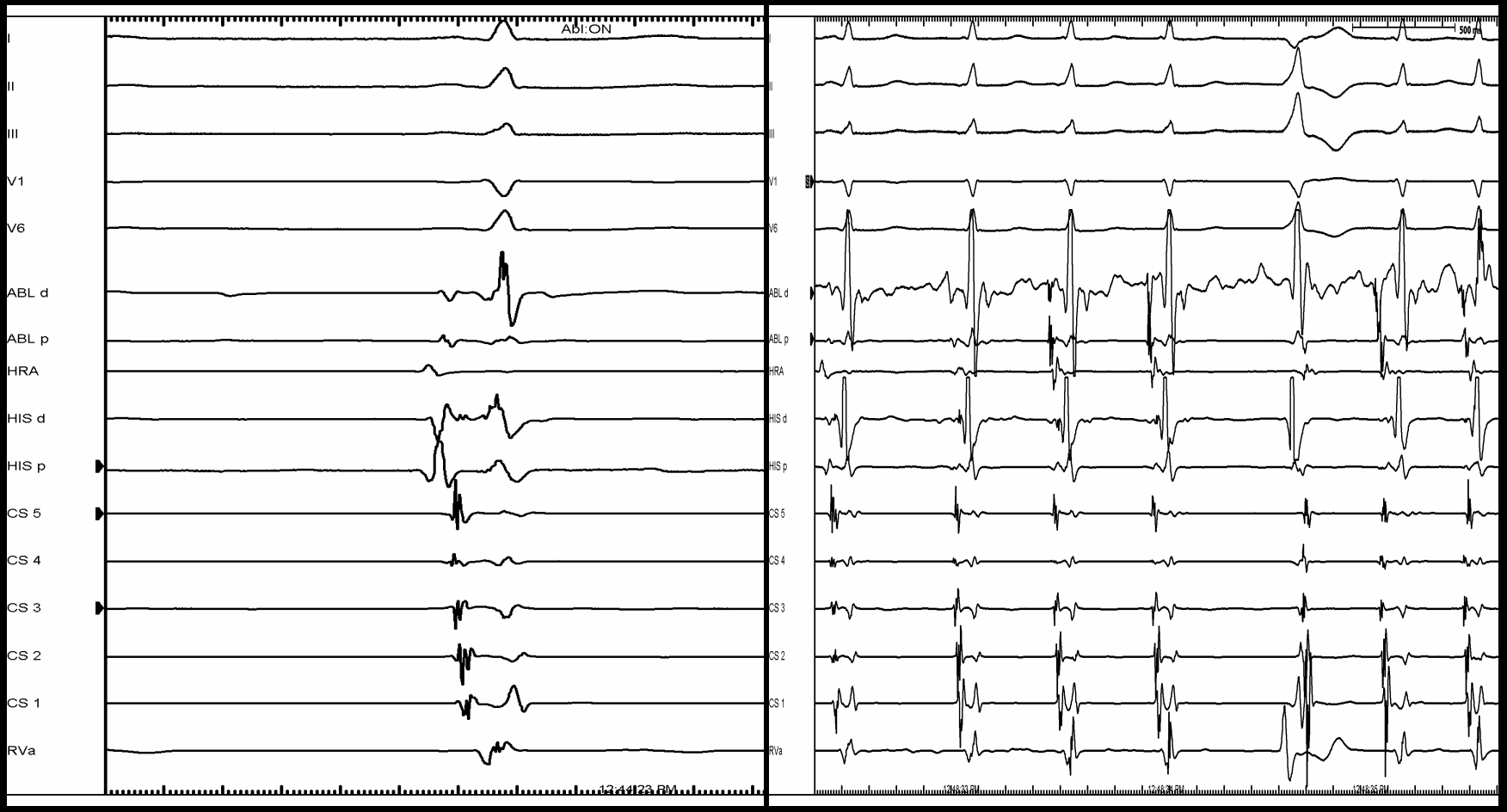

S1S1: 370
500 ms
I
II
III
V1
V6
HRA
HIS d
HIS p
CS 5
CS 4
CS 3
CS 2
CS 1
RVa

AVNRT with VA block

AVNRT- Management

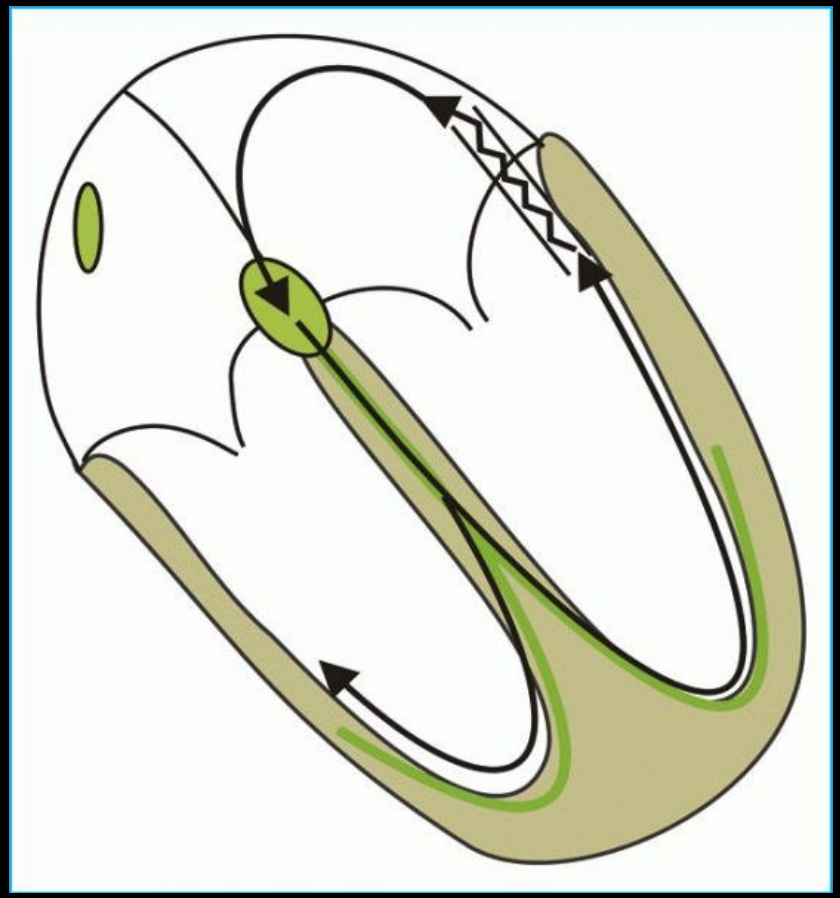
- Decisions based on symptoms and frequency.
- Conservative management
  - Vagal maneuvers
  - AVN blockers (CCB,BB,Dig)
  - (AAD: Ic, Ia, III)
- Ablation

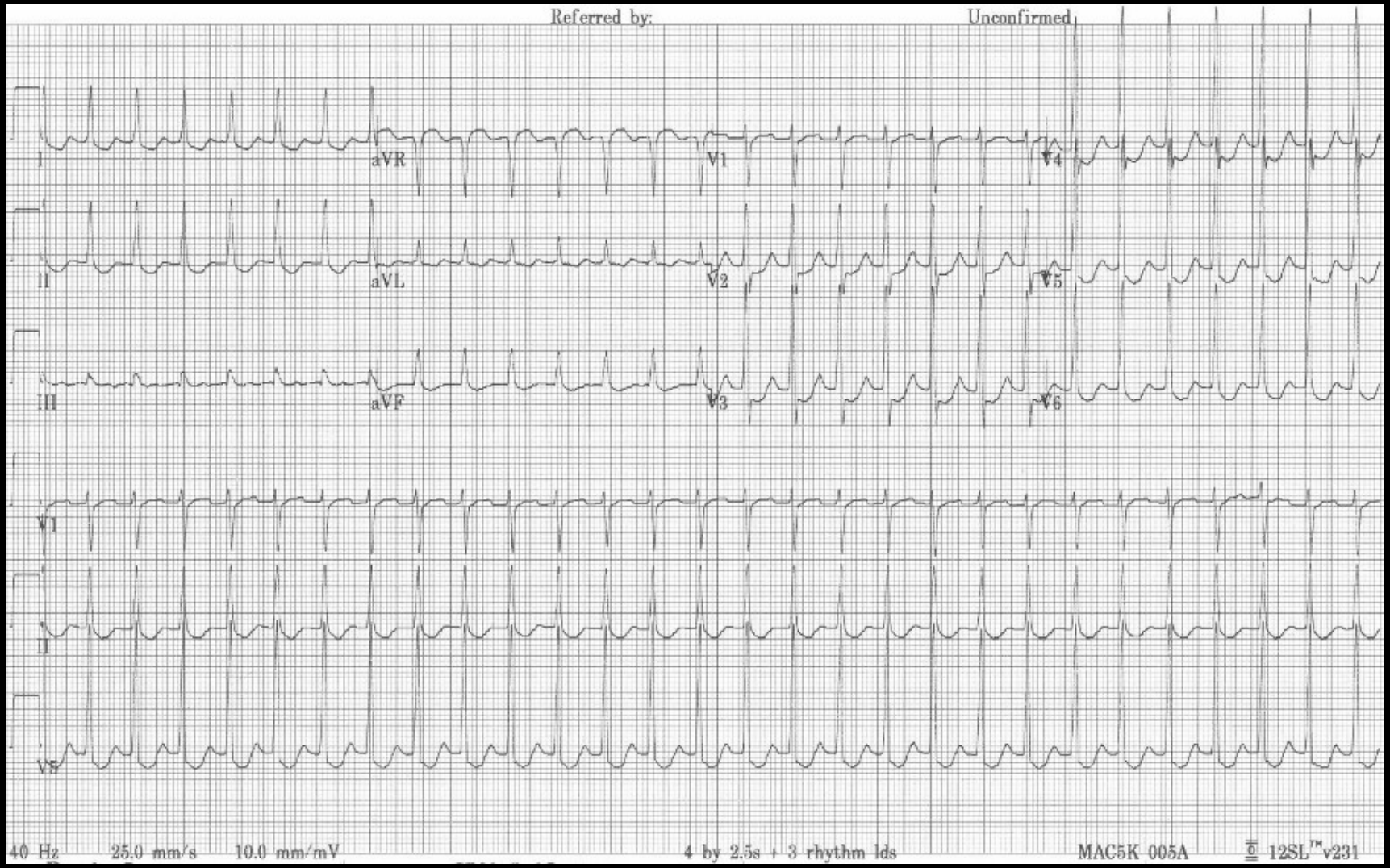
Ablation site AVNRT



Orthodromic AVRT ECG

- RP>90ms
- P waves are suggestive of AP site
- P wave can be “non-retrograde”
- Never AV or VA block
- Ipsilateral BBB – slower CL d/t longer VA
- His Ref VPC resets SVT

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I
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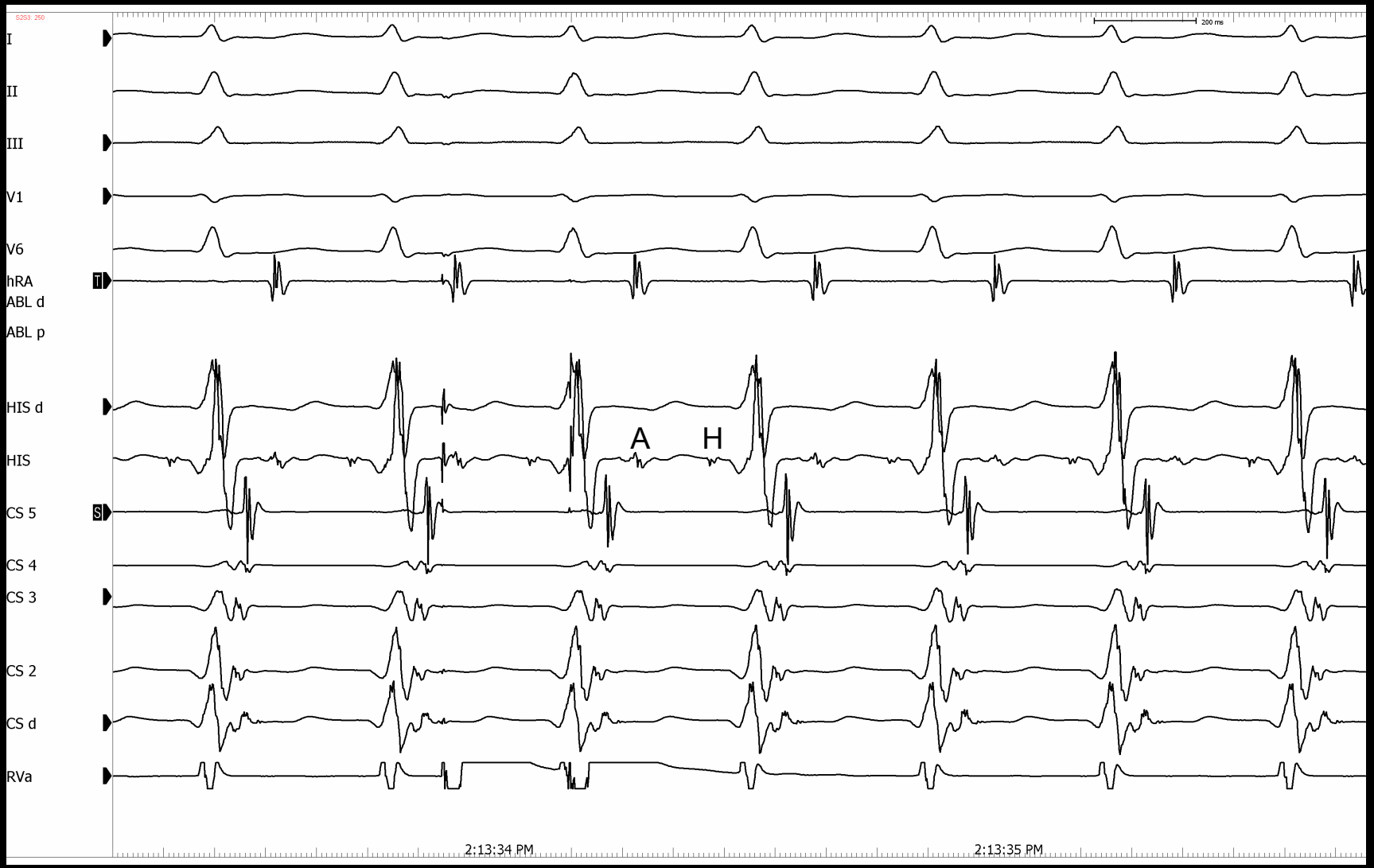
III
aVF
V3
V6
V1
II
V5
40 Hz
25.0 mm/s
10.0 mm/mV
4 by 2.5s + 3 rhythm lds
MAC5K 005A
12SL™v231

Orthodromic AVRT EP

- Initiation requires AV delay
- Activation sequence is not concentric (can be with septal BT- DD with uncommon AVNRT)
- 1:1 VA , can not have AV or VA block
- Ipsilateral BBB prolongs TCL and most importantly VA time
- SVT can be reset or terminated with His Ref VPC

- VA>60 ms
- In case of SVT with concentric A activation requires pacing maneuvers and VPC s to DD from atypical AVNRT.

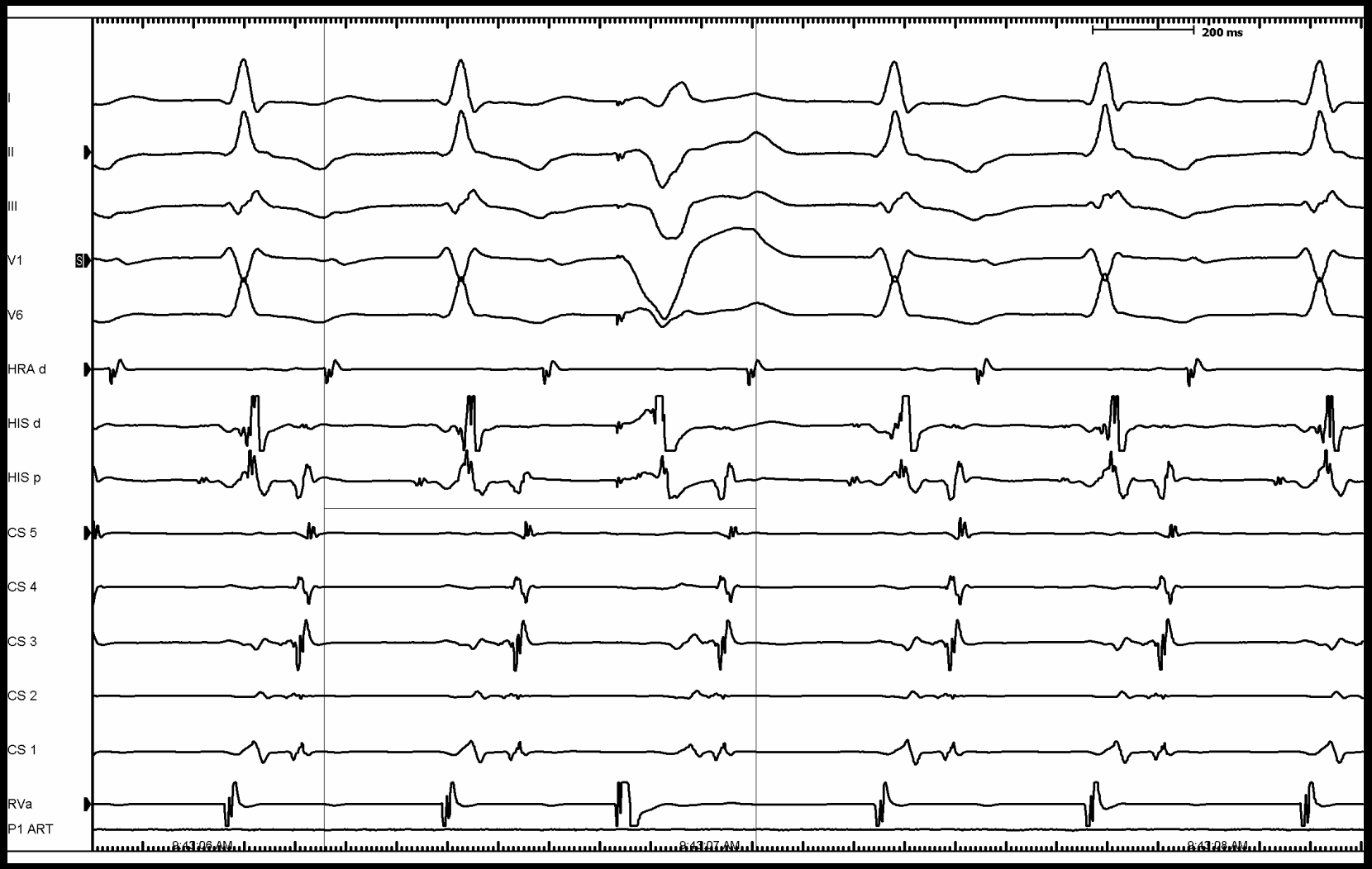
SVT Left Lateral BT



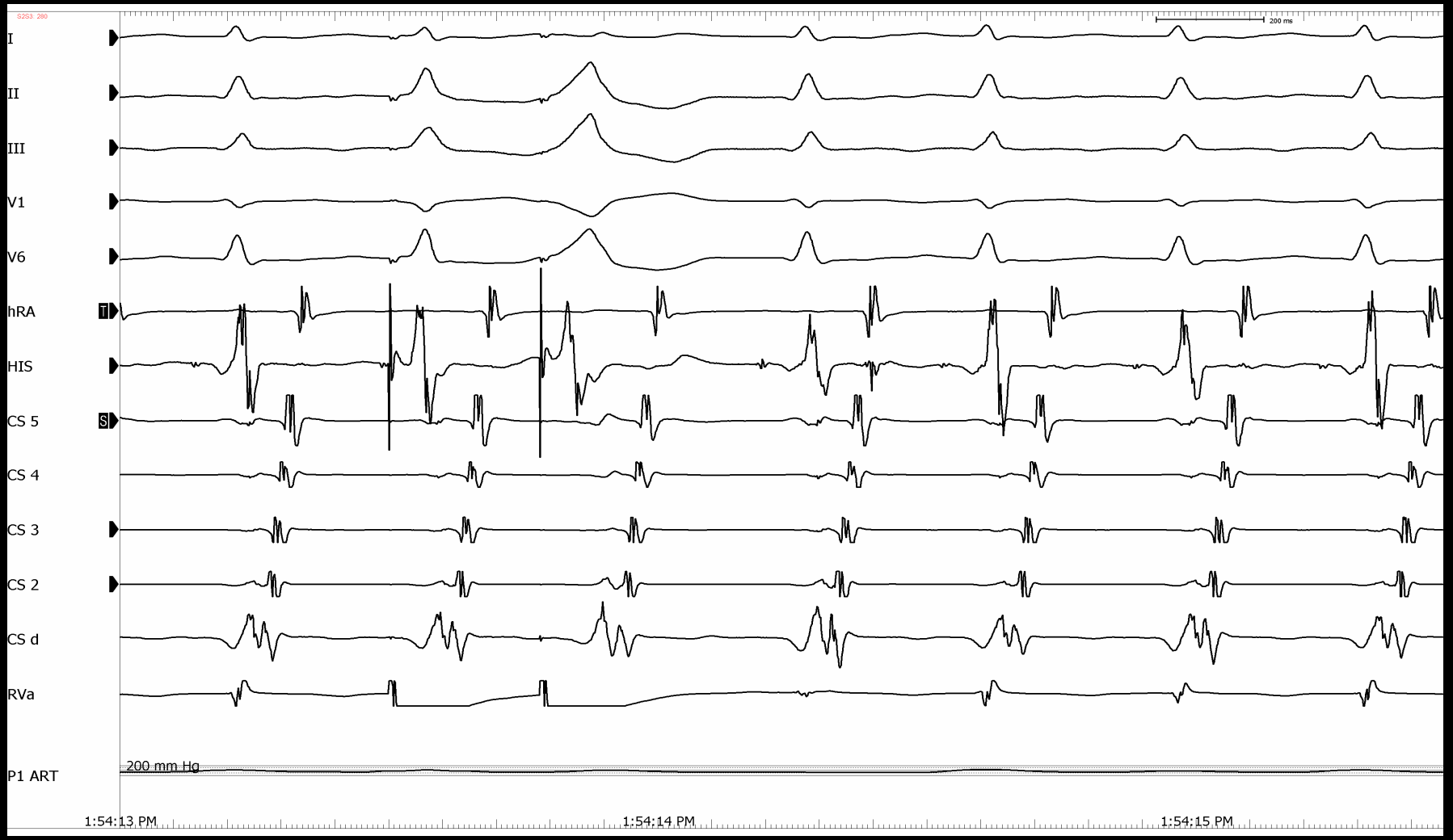
AVRT Rt sided BT


I
II
III
V1
V6
CS 5
S
CS 4
CS 3
CS 2
CS d
RVa
P1 ART
200 mm Hg
1:48:10 PM
1:48:11 PM

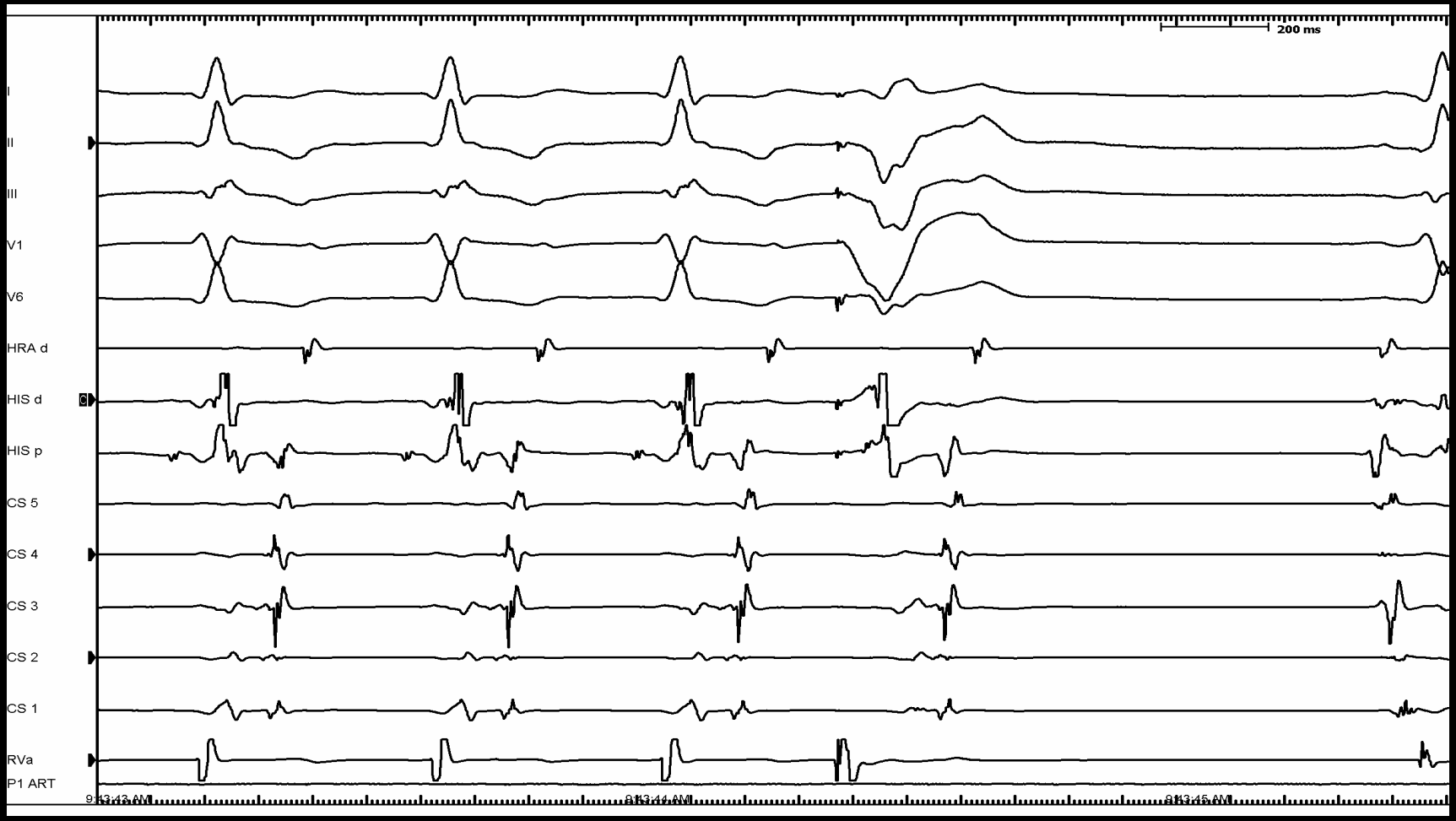
His Refr VPC resets SVT



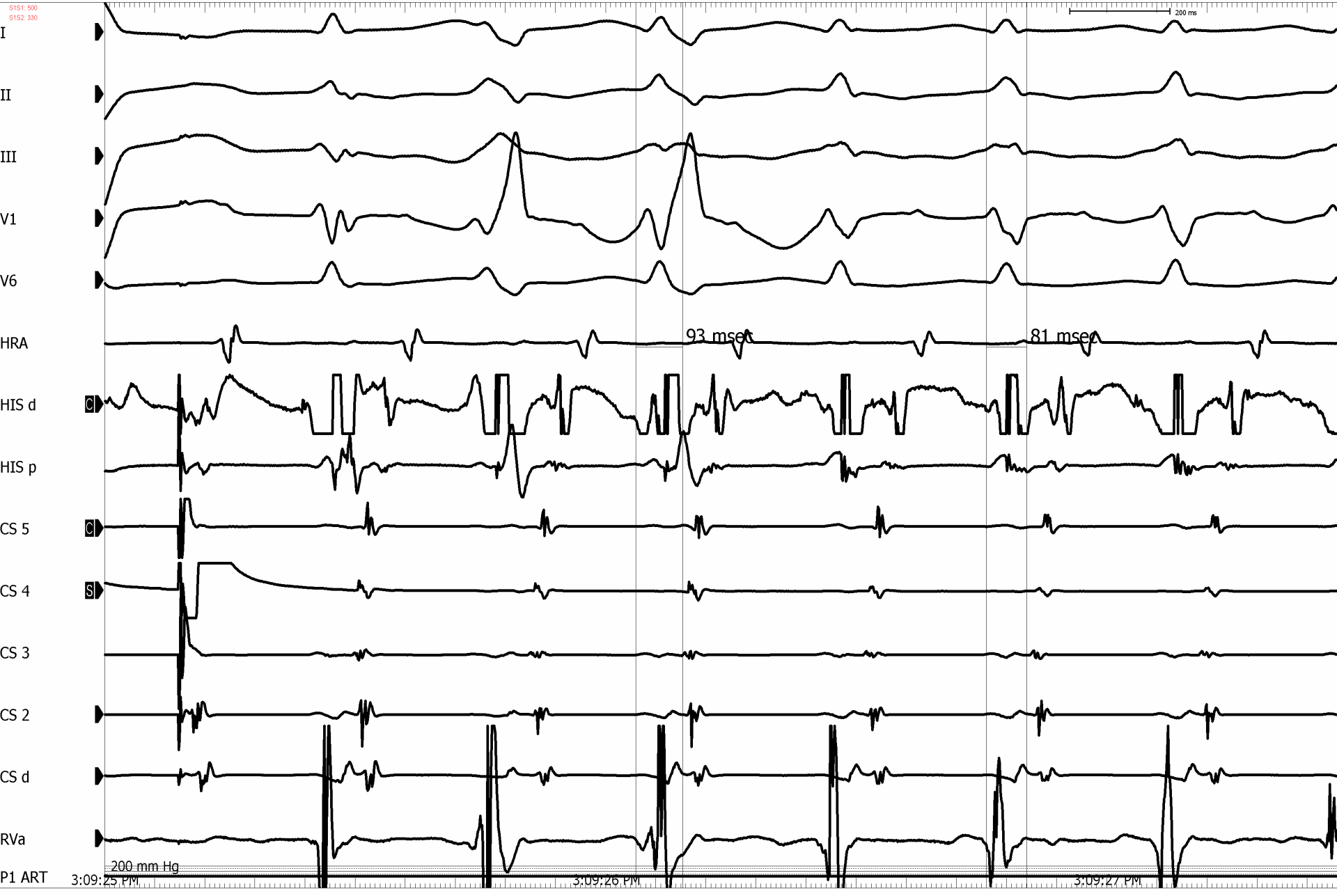
His Refractory VPC causing Delay in SVT



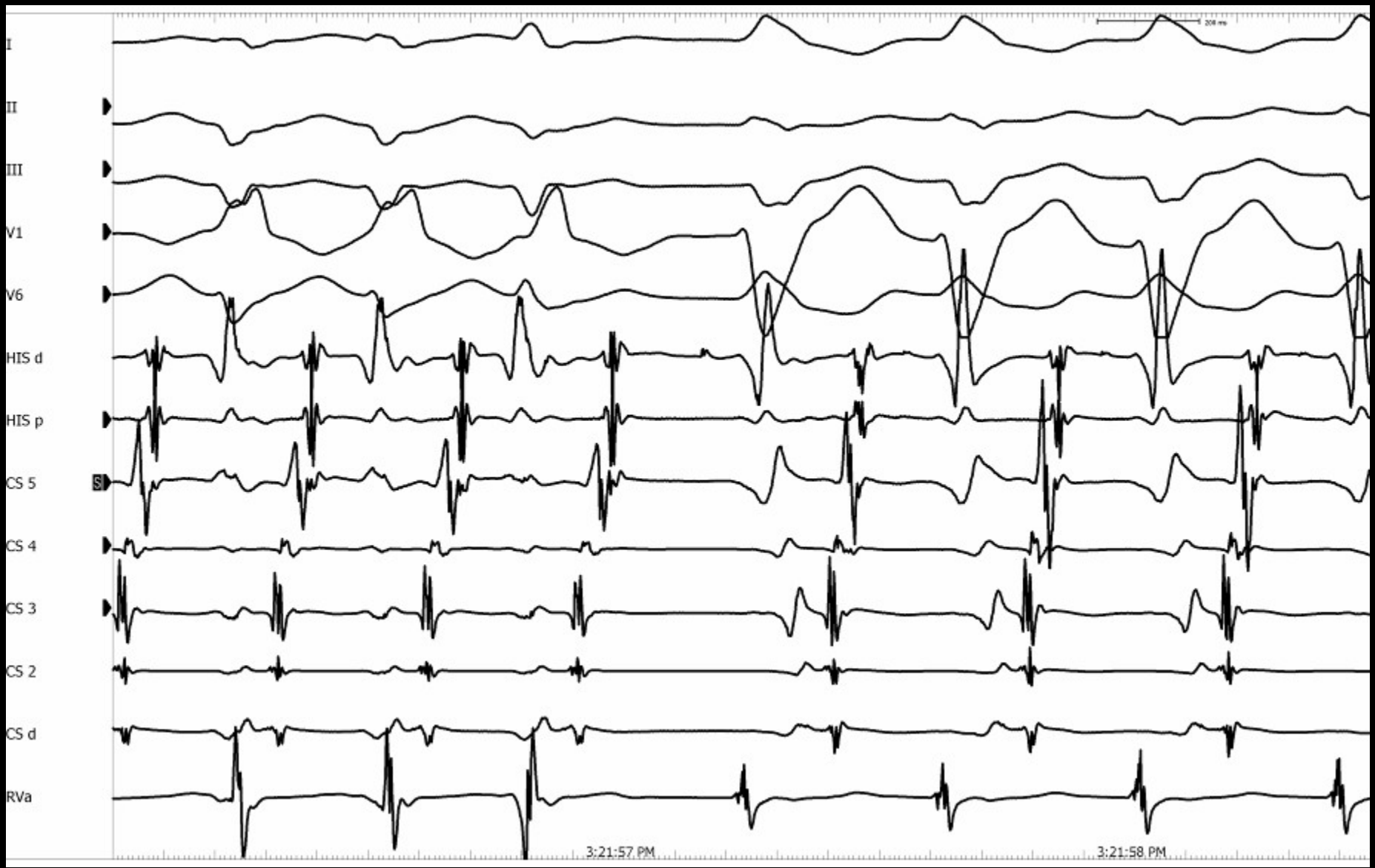
His Ref VPC (-70ms) advances an terminates SVT




200 ms
I
II
III
V1
V6
HRA
HIS d
HIS p
CS 5
CS 4
CS 3
CS 2
CS d
RVa
P1 ART
200 mm Hg
3:25:20 PM
3:25:21 PM


S1S1: 500
S1S2: 330
200 ms
I
II
III
V1
V6
HRA
93 msec
81 msec
HIS d
HIS p
CS 5
CS 4
CS 3
CS 2
CS d
RVa
P1 ART
200 mm Hg
3:09:25 PM
3:09:26 PM
3:09:27 PM

Spontaneous during SVT



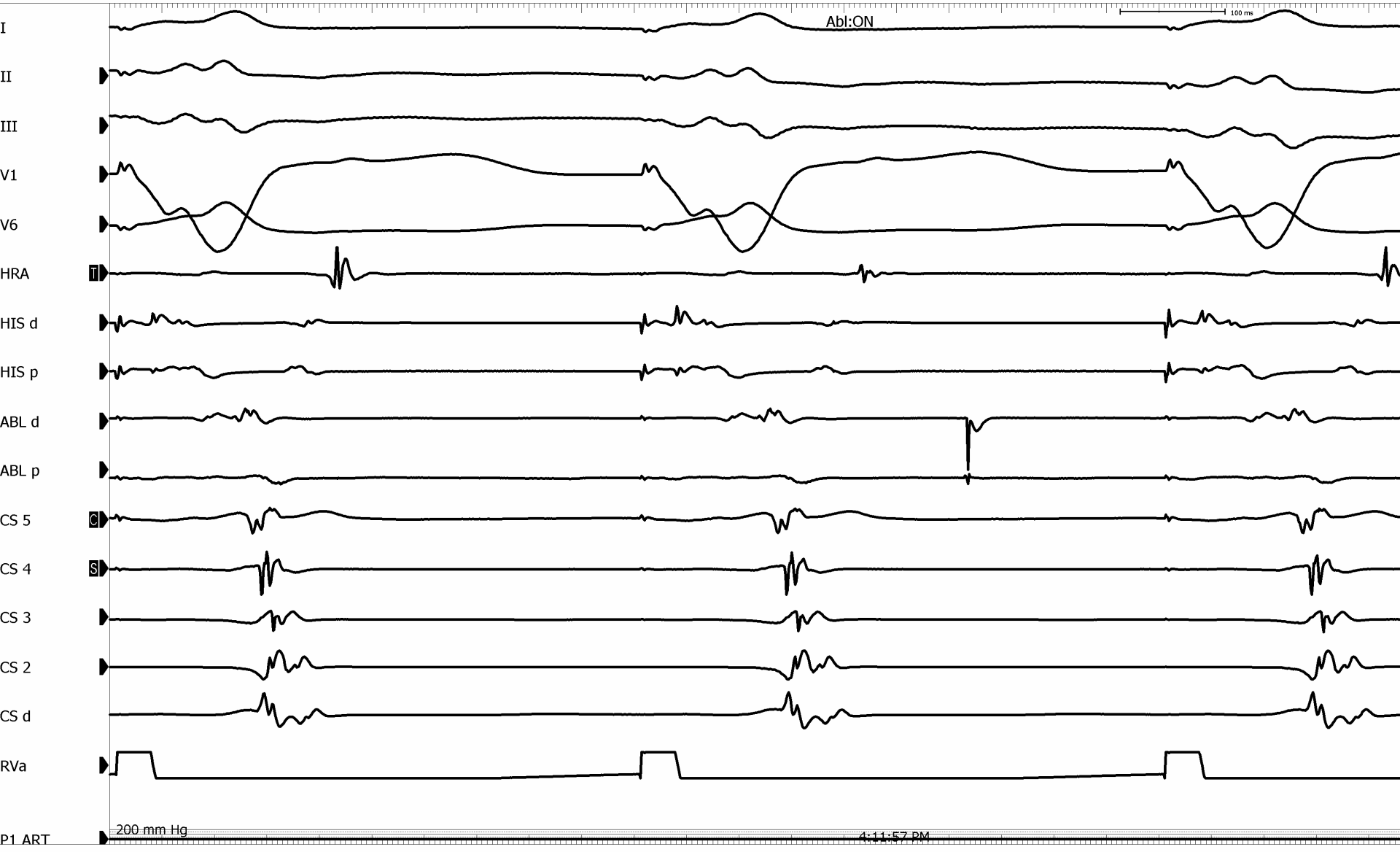
Difficult DD- Septal BT (especially slow and Uncommon AVNRT)

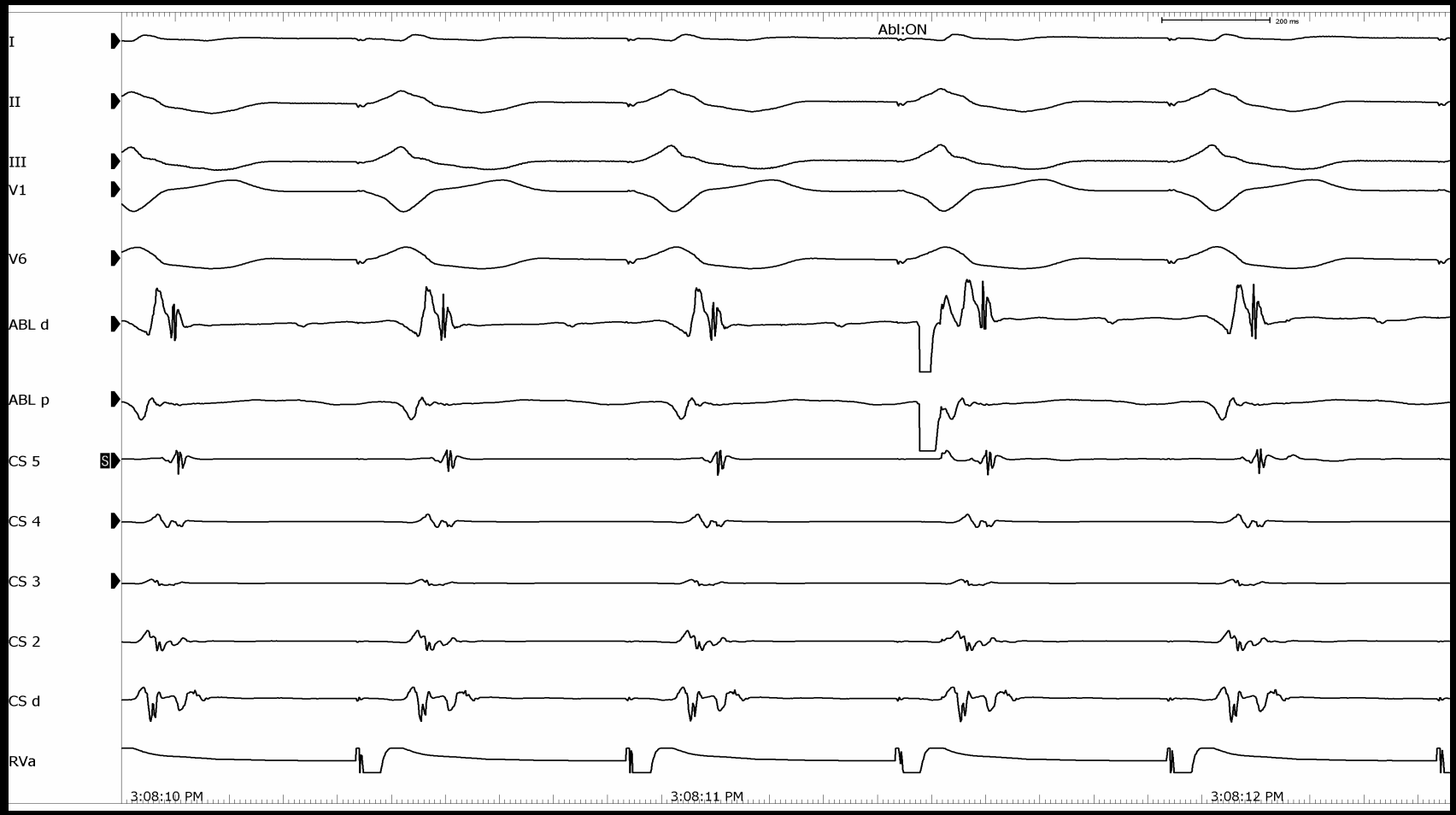
- His Refractory VPC
- V Pacing
- VA svt-VA rva pacing
- VA basal pacing- VA apical pacing
- Para Hisian Pacing
- Preexcitation Index

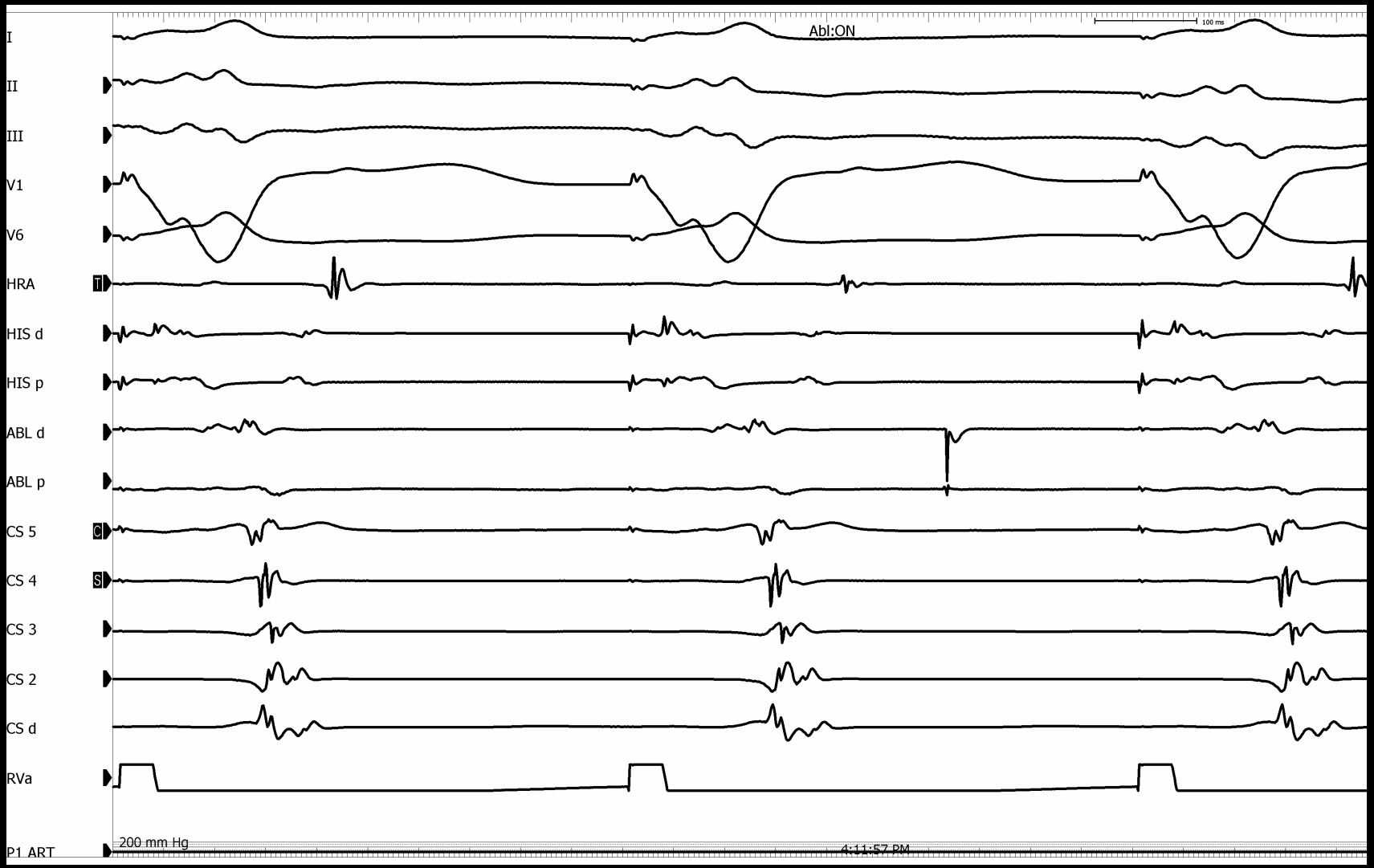
AVRT- Management

- (Conservative)
- Medical-
  - AVN Blockers: BB or CCB (not in WPW with good antegrade conduction)
  - Antiarrhythmics- Class III, Ia, Ic
- Ablation

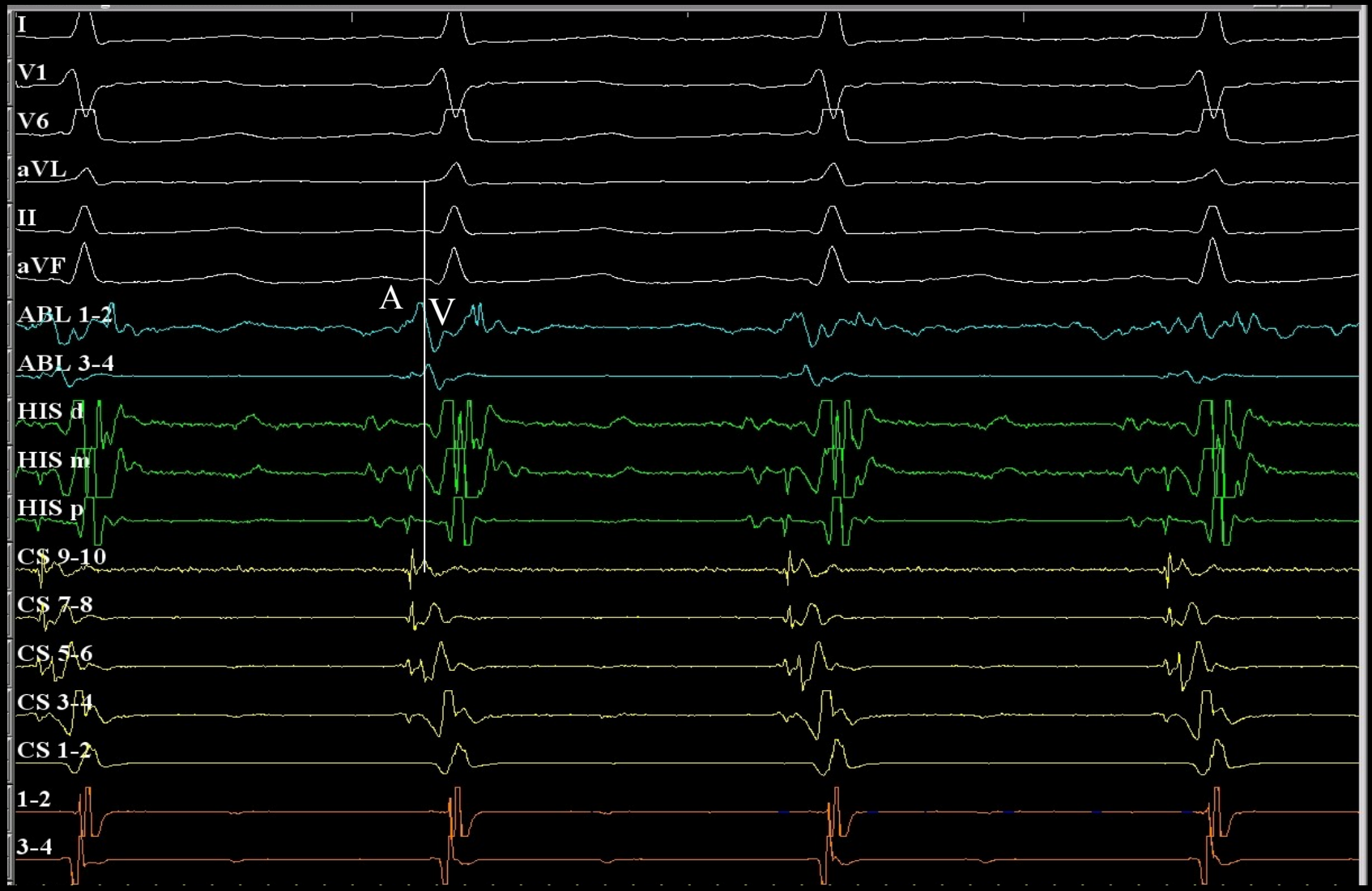
Ablation Site



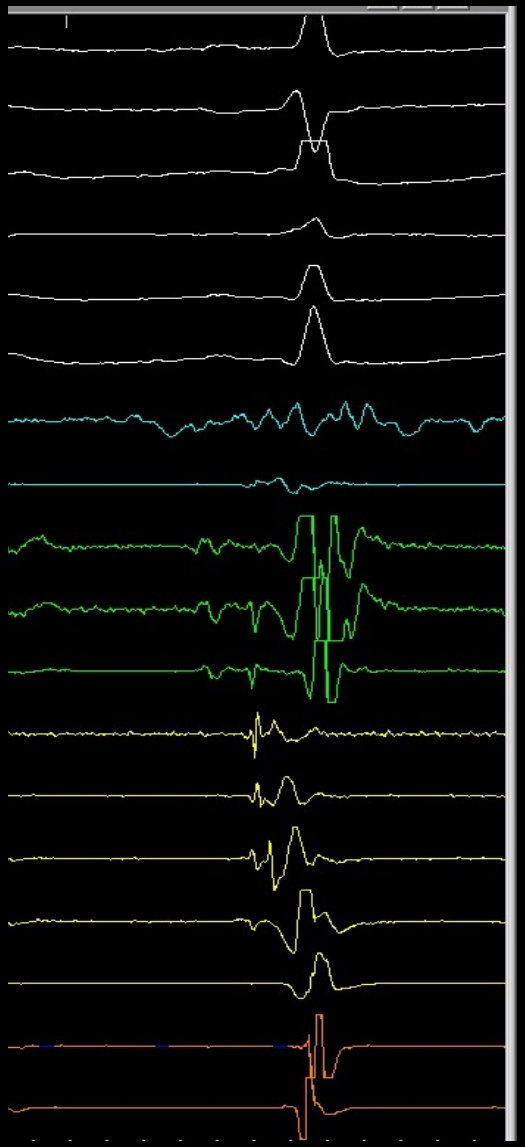

Abl:ON
200 ms
I
II
III
V1
V6
ABL d
ABL p
CS 5
S
CS 4
CS 3
CS 2
CS d
RVa
3:08:10 PM
3:08:11 PM
3:08:12 PM


Abl:ON
100 ms
I
II
III
V1
V6
HRA
HIS d
HIS p
ABL d
ABL p
CS 5
CS 4
CS 3
CS 2
CS d
RVa
P1 ART
200 mm Hg
4:11:57 PM

Successful Ablation site

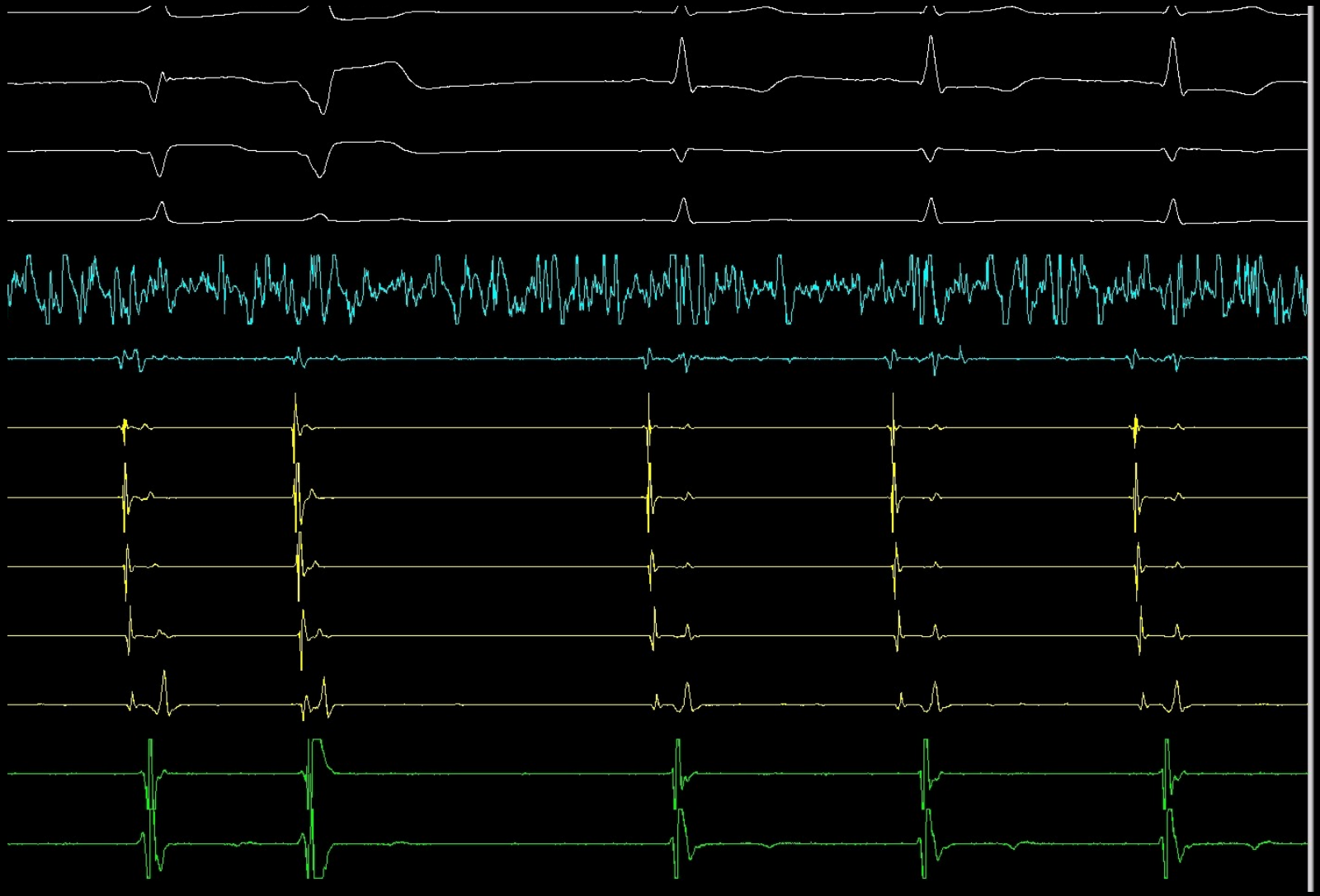


Pre Ablation

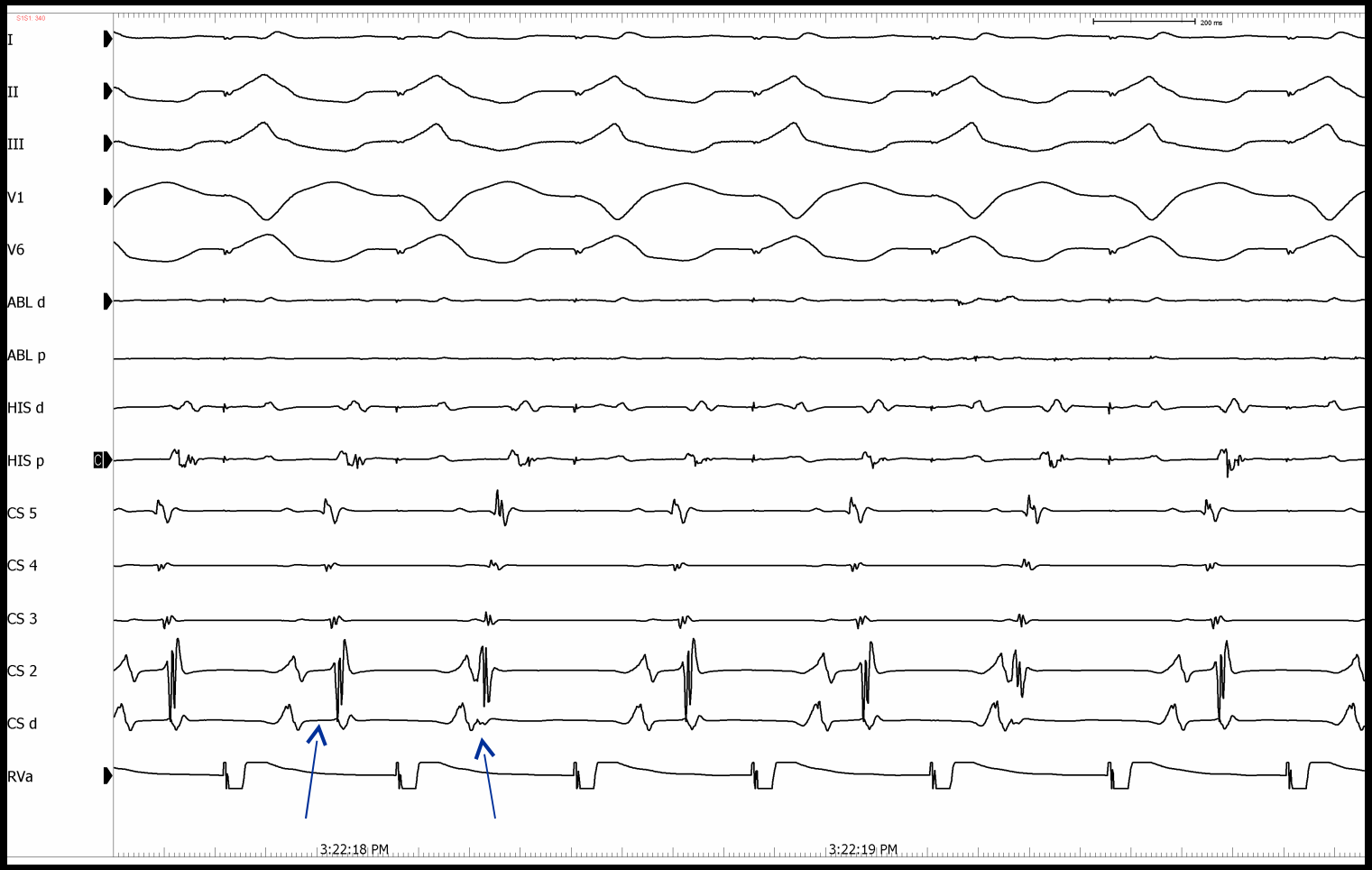


Post Ablation

Loss of Preexcitation

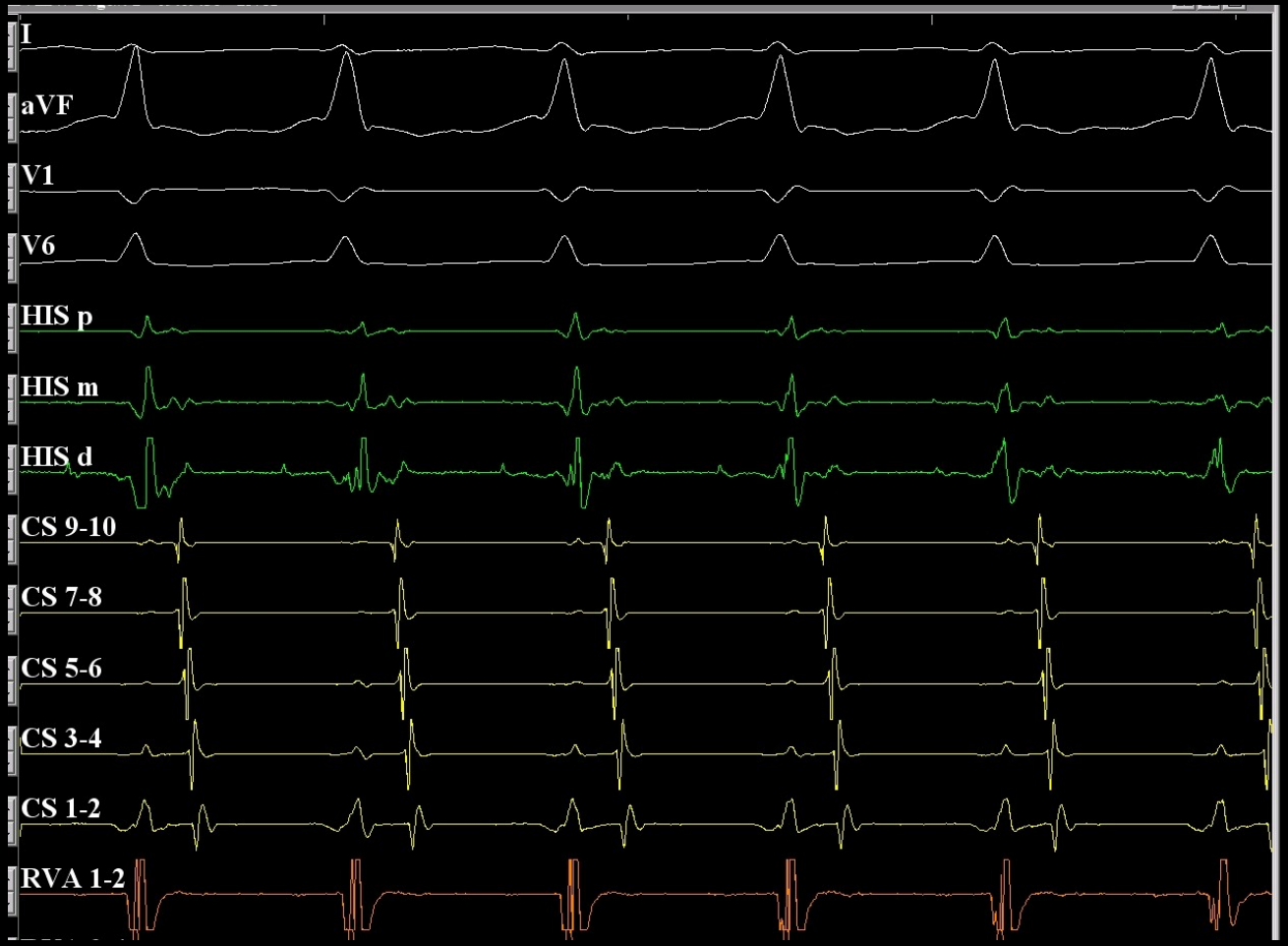


Ablation sites



Ablation site ECG

AVRT



Ablation site

Ablation Site

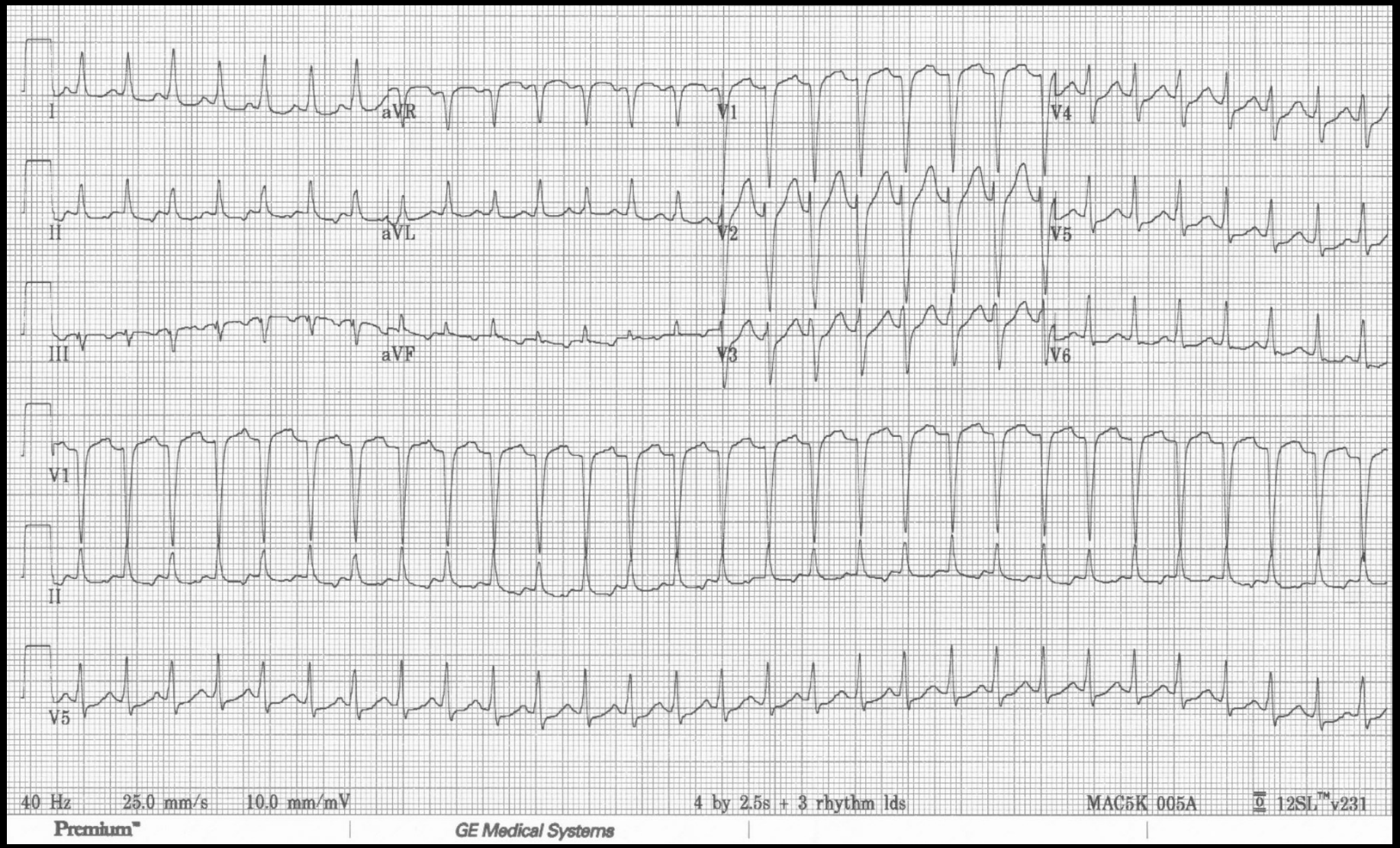
AT-ECG

- P > R
- Non retrograde P wave
- Automaticity or Triggered Activity

AT ECG Localiztion

- Left vs Right: Positive in V1 , negative in avL
- Inf vs. superior
- Narrow P vs Broad and notched
- Positive P waves in precordium: PV origin
- Negative P waves in precordium- Tricuspid annulus
- Exceptions :MA tachycardia, RSPV, CS

AT-ECG


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
II
V5
40 Hz
25.0 mm/s
10.0 mm/mV
4 by 2.5s + 3 rhythm lds
MAC5K 005A
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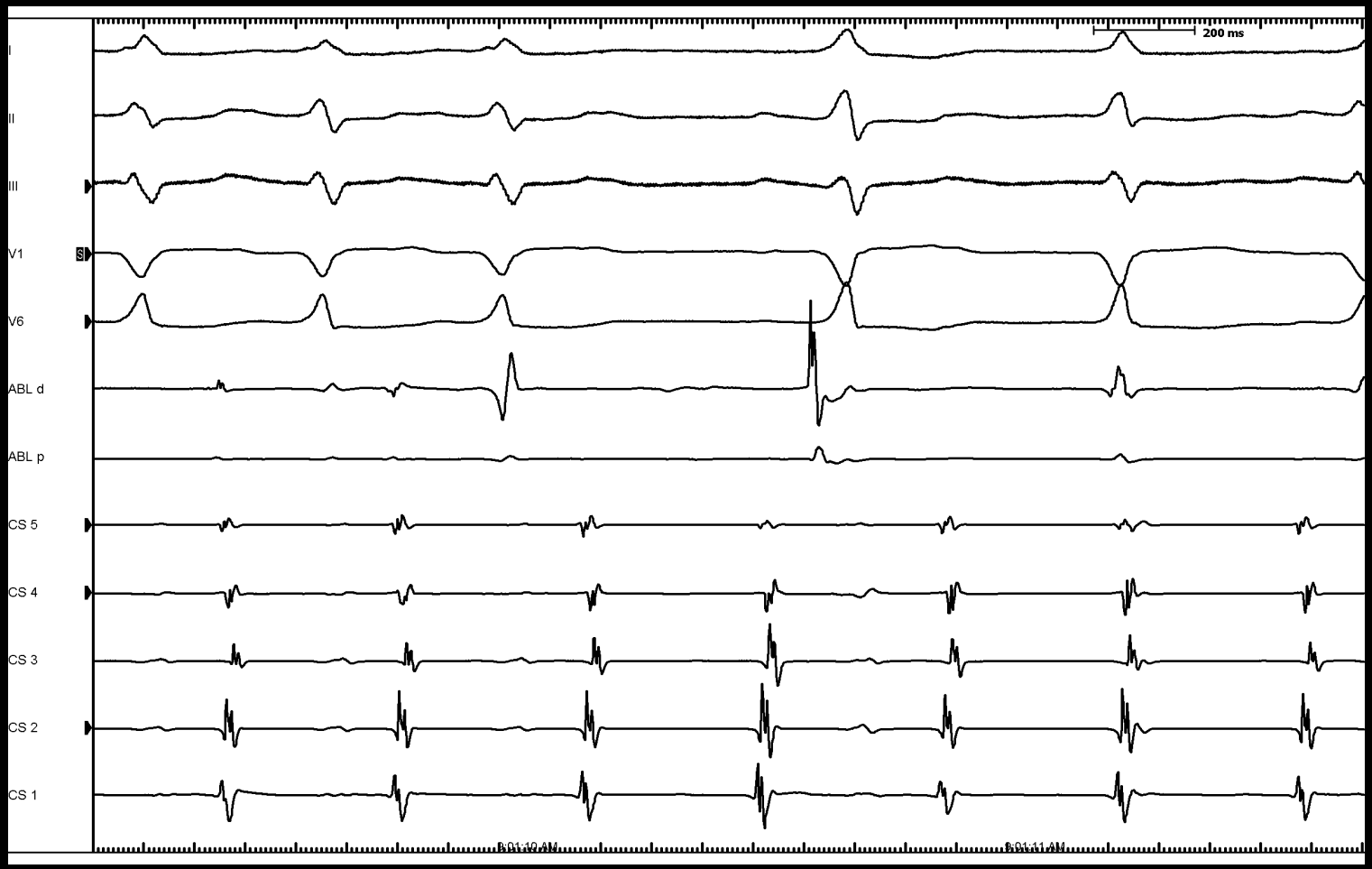
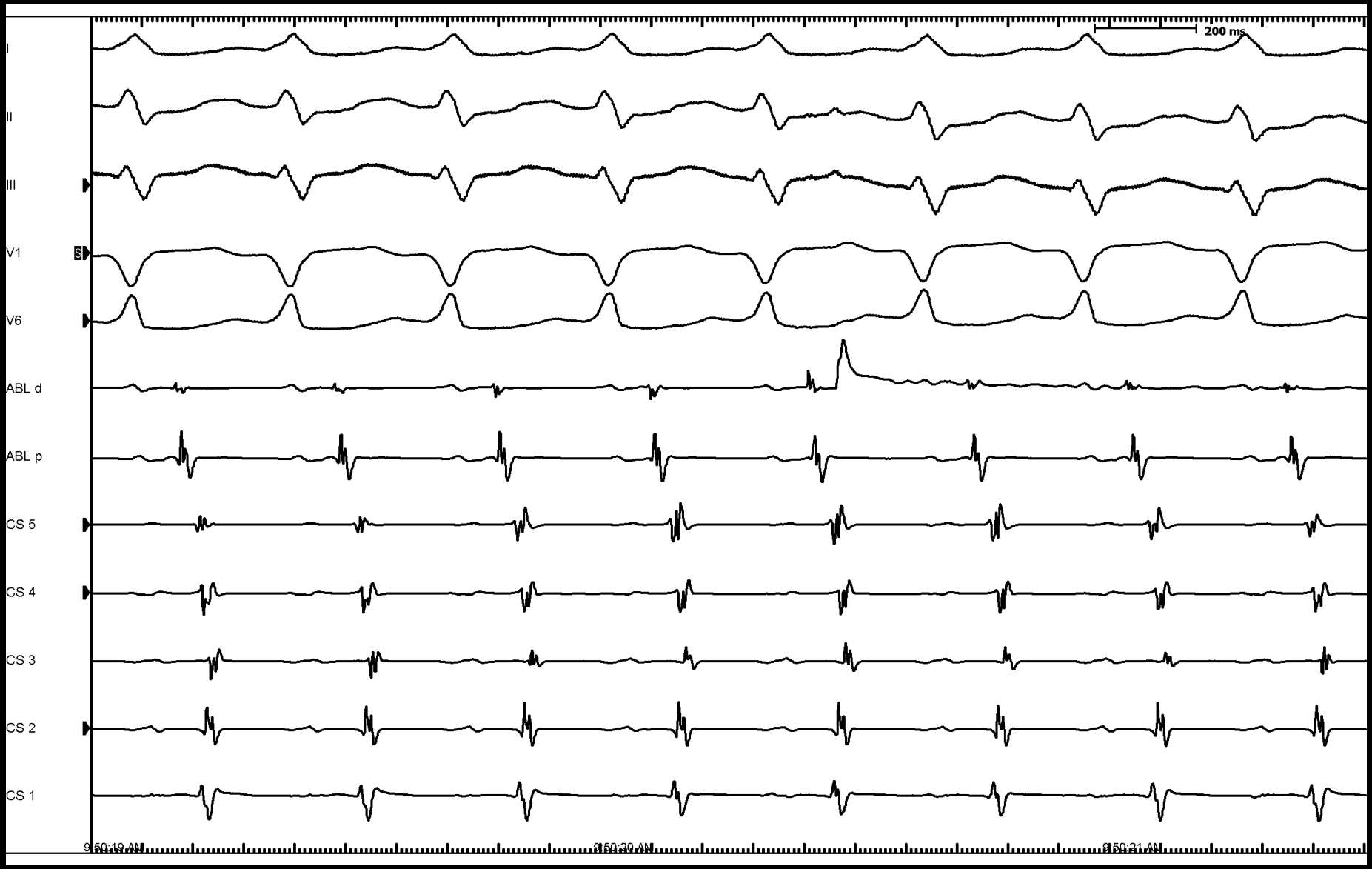
Premium™
GE Medical Systems


200 ms
I
II
III
V1
V6
ABL d
ABL p
CS 5
CS 4
CS 3
CS 2
CS 1

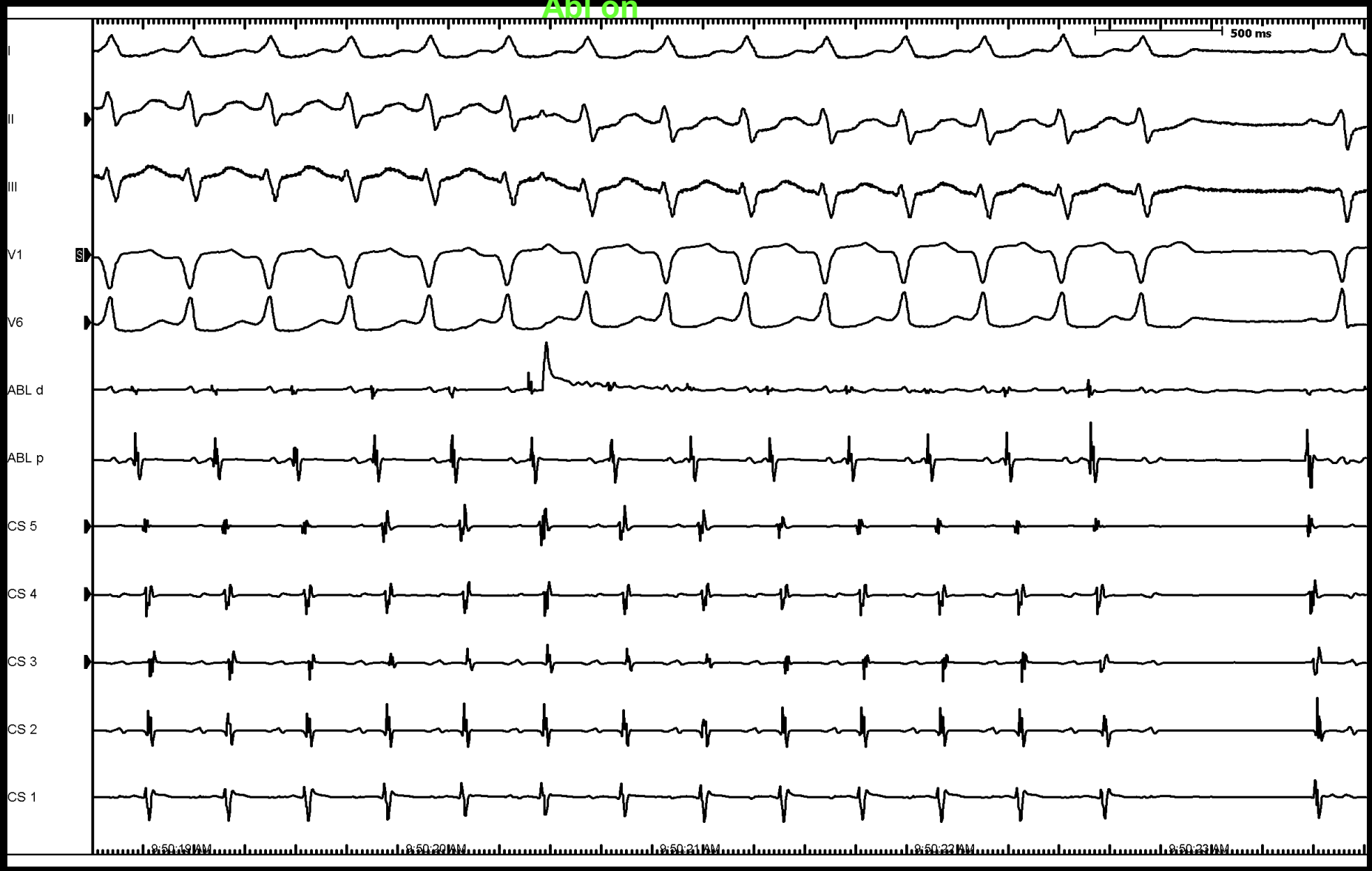
EP Mapping

- More A> V
- Focal AT- (automatic or trigerred): Earliest A compared to reference or surface P wave (Q in Unipolar ablation catheter)
- Macro reentrant AT= Entrainment map and line in critical isthmus (example: TV-IVC Isthmus dependent Flutter)

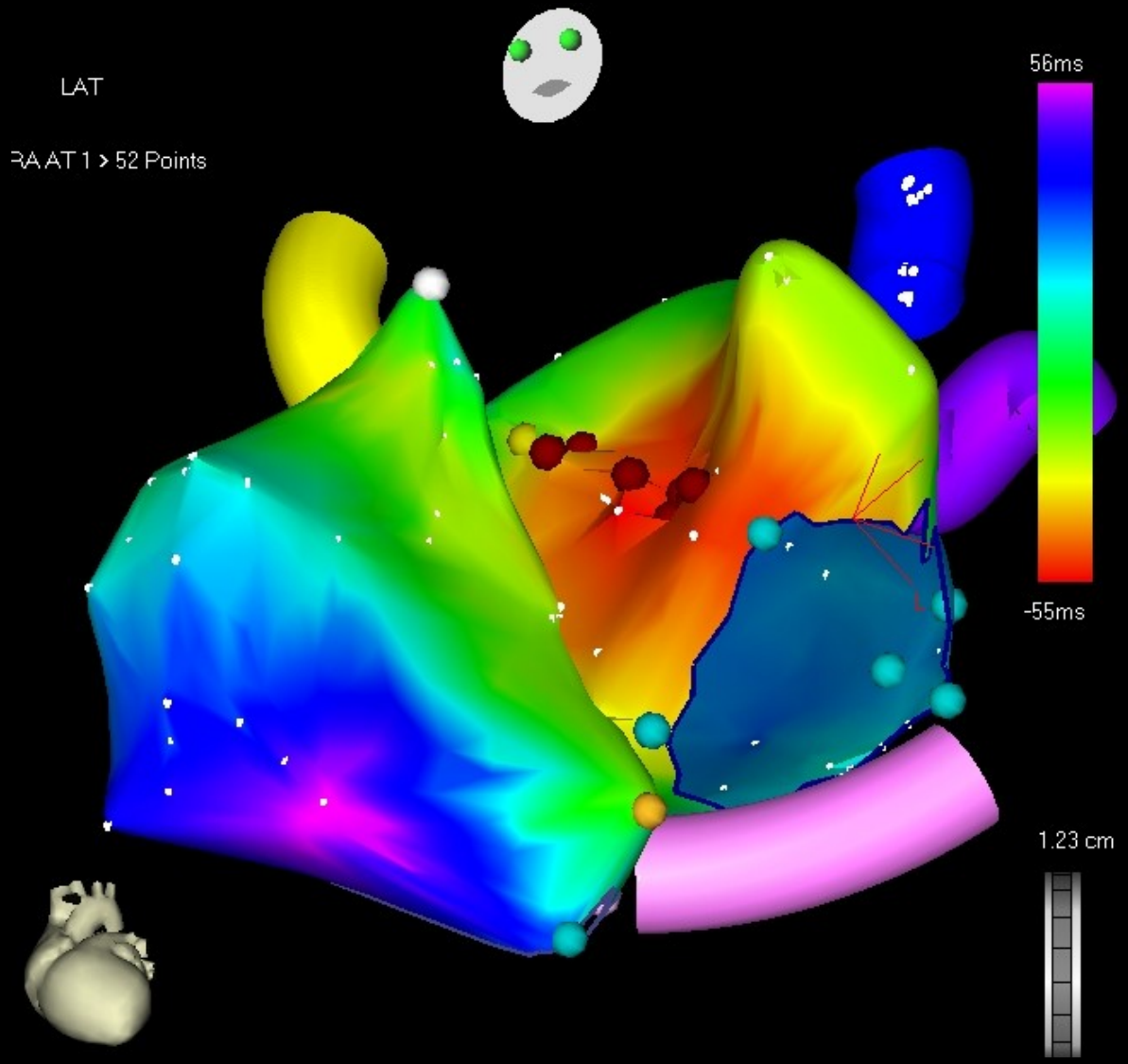
Earliest site of activation



During 1st ablation



View of both atria with ablations

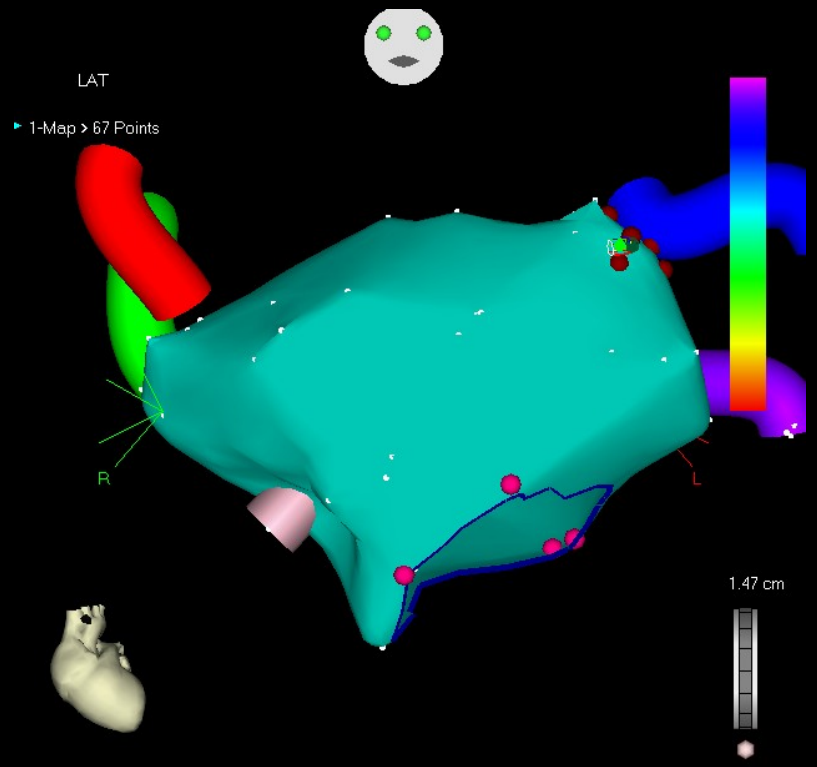


Managemant

- BB, CCB
- Antiarrhythmics
- Ablation

Ablation site

Atrial Fibrillation



ACC/AHA/ESC 2006 Guidelines for Management of Patients With Atrial Fibrillation (J Am Coll Cardiol 2006;48:854-906
Expert Consensus Statement on Catheter and Surgical Ablation for AF. (Heart Rhythm June 2007)

Definitions

- *Paroxysma*l- Self Terminating within 7 days
- *Persistent* – Requires Termination (DCCV or AAD) or terminates > 7d
- *Long-Term Persistent* – Lasts longer than 1 yr
- *Permanent=Chronic* – Fails CV or not attempted

Diagnosis

- Based on ECG
- **Assessment of <u>Underlying Causes</u>:**
  - HTN, Valve Heart Disease, Cardiac Function, Cardiac Function, TSH
  - Other arrhythmia- Flutter, AVRT, AT
- **Assessment of Precipitating Factors**: Fever, Hypoxia, Ischemia, Anemia, Alcohol, Drugs.

Acute Management

- **Unstable Patient**: Acute HF, Hypotensive, Ischemic>>> DC Cardioversion
- 200 J shock Biphasic

- **Stable Patient –** New Onset? (<48 hrs), Or > 48 hrs

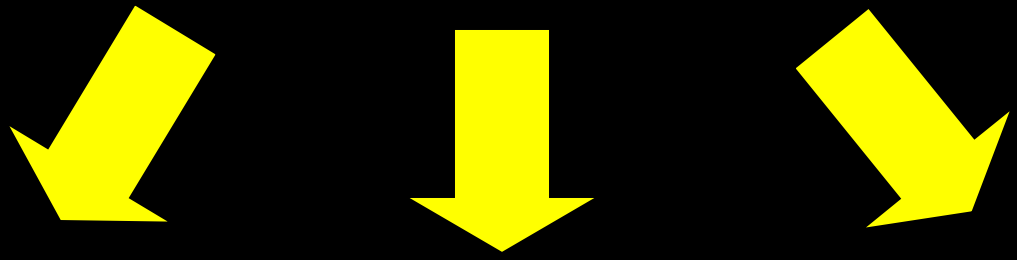
Acute AF- Less Than 48 Hours

- Preferred Approach- Acute Rate Control and Restoration to NSR on Heparin
  - Preferably by DC Cardioversion
  - Optional by AAD (Guidelines Table and Figure)
- 4 Weeks anticoagulation post DC-CV (Guidelines??)
- Long Term Decisions: - AAD?, Anticoagulation after 4 weeks

Persistent and Long-Term Persistent (Permanent/Chronic) AF

- **Rate vs Rhythm Control**
  - Main Studies of AAD vs. Medical Rate Control
  - Recent Studies with Dronaderone
  - Limitations of these studies

Management



Thromboembolism Prevention

Heart rate Control

Restoration of Sinus Rhythm

Anti-arrhythmic Drug Therapy

TABLE 7. Trials Comparing Rate Control and Rhythm Control Strategies in Patients With AF

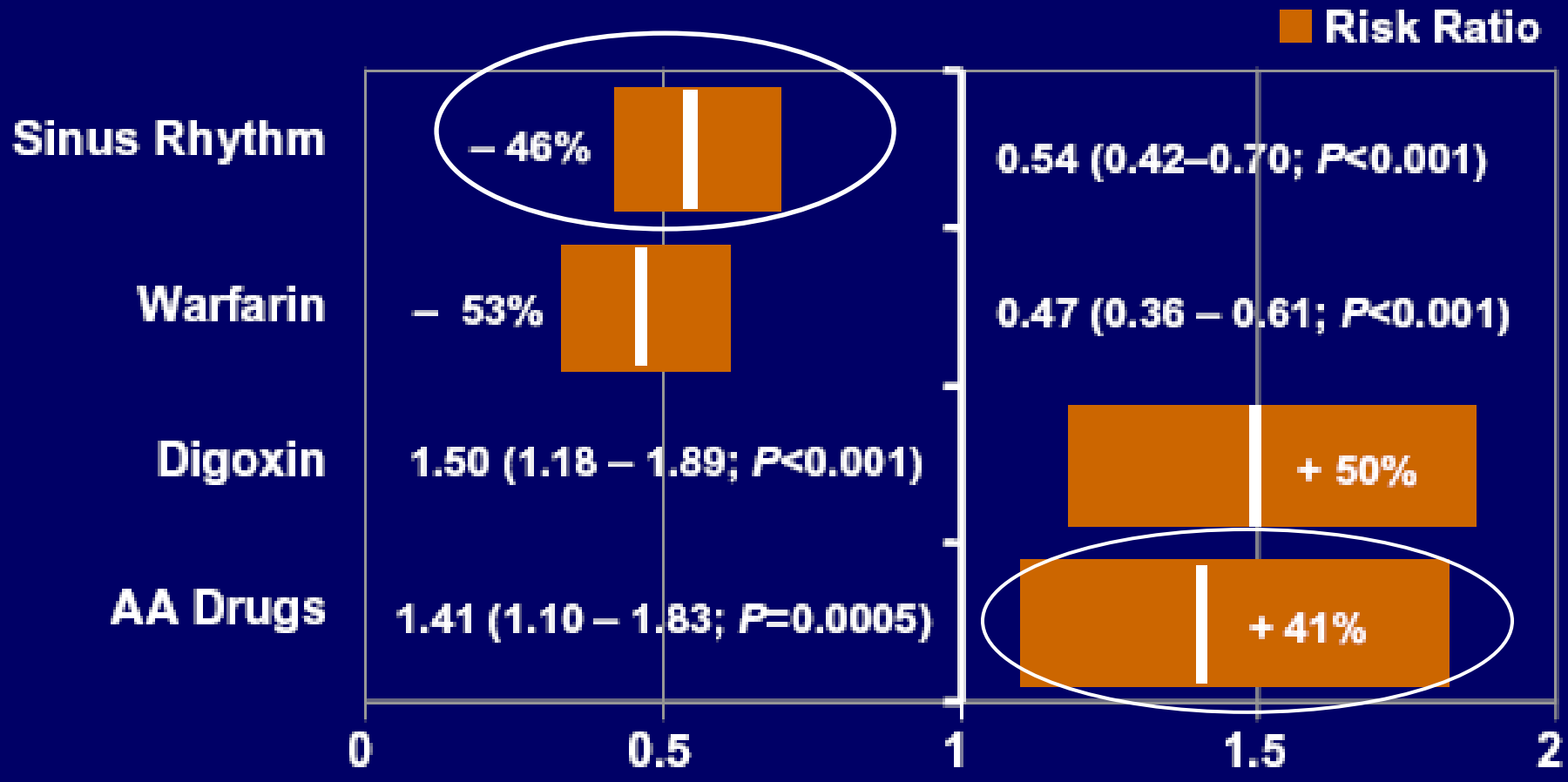
							Clinical Events (n)			
							Stroke/Embolism		Death	
Trial	Reference	Patients (n)	AF Duration	Follow-Up (y)	Age (mean y ±SD)	Patients in SR*	Rate	Rhythm	Rate	Rhythm
AFFIRM (2002)	296	4060	†/NR	3.5	70±9	35% vs. 63% (at 5 y)	88/2027	93/2033	310/2027	356/2033
RACE (2002)	293	522	1 to 399 d	2.3	68±9	10% vs. 39% (at 2.3 y)	7/256	16/266	18/256	18/266
PIAF (2000)	294	252	7 to 360 d	1	61±10	10% vs. 56% (at 1 y)	0/125	2/127	2/125	2/127
STAF (2003)	343	200	6±3 mo	1.6	66±8	11% vs. 26% (at 2 y)	2/100	5/100	8/100	4/100
HOT CAFÉ (2004)	344	205	7 to 730 d	1.7	61±11	NR vs. 64%	1/101	3/104	1/101	3/104

*Comparison between rate and rhythm control groups.

†Approximately one third of patients were enrolled with first episode of atrial fibrillation (AF).

AFFIRM indicates Atrial Fibrillation Follow-Up Investigation of Rhythm Management; HOT CAFÉ, How to Treat Chronic Atrial Fibrillation; NR, not reported; PIAF, Pharmacological Intervention in Atrial Fibrillation; RACE, Rate Control Versus Electrical Cardioversion for Persistent Atrial Fibrillation; SR, sinus rhythm; and STAF, Strategies of Treatment of Atrial Fibrillation.

AFFIRM: Predictors of Mortality



*Other significant factors in model: age, CAD, CHF, smoking, stroke/TIA, normal LVEF, MR.

The AFFIRM Investigators. *Circulation*. 2004;109:1509-1513.

AF-CHF

NEJM 2008 358:2667-2677

- Pts with LVEF<35%, CHF, AF
- Randomized to Rate vs Rhythm Control
  - No differences were found in Death, Stroke rates or HF or combined outcome during 3 yr f/up
- In patients with atrial fibrillation and CHF, a routine strategy of rhythm control does not reduce the rate of death from cardiovascular causes, as compared with a rate-control strategy

Dronedarone

- Dronedarone is a novel antiarrhythmic drug with electrophysiological properties that are similar to those of amiodarone, but it does not contain iodine and thus does not cause iodine-related adverse reactions

Dronedarone

- 1000 patients who were hospitalized with symptomatic heart failure and severe left ventricular systolic dysfunction to receive 400 mg of dronedarone twice a day or placebo. The primary end point was the composite of death from any cause or hospitalization for heart failure.

Dronedarone

- trial was prematurely terminated for safety reasons,
- During a median follow-up of 2 months, 8.1% in the Dronedarone group and 12 3.8% in the placebo group died (hazard ratio in the dronedarone group, 2.13; 95% confidence interval [CI], 1.07 to 4.25; P=0.03).

Athena

HRS 2008, ESC 2008

- 4600 pts with AF or A flutter
- Decline in CV death (25%), arrhythmic death (45%), stroke (34%)

- Not approved yet by FDA ongoing trials to conform these findings

PABA CHF

NEJM Volume 359:1778-1785

- Pts with symptomatic, drug-resistant AF, LVEF of 40% or less, and NYHA class II or III to undergo either PVI or atrioventricular-node ablation with biventricular pacing.

PABA CHF

NEJM Volume 359:1778-1785

- The composite primary end point favored the group that underwent pulmonary-vein isolation, with an improved quality of life at 6 months ($P<0.001$), a longer 6-minute-walk distance (340 m vs. 297 m, $P<0.001$), and a higher ejection fraction (35% vs. 28%, $P<0.001$). In the group that underwent pulmonary-vein isolation, 88% of patients receiving antiarrhythmic drugs and 71% of those not receiving such drugs were free of atrial fibrillation at 6 months.

PABA CHF

NEJM Volume 359:1778-1785

- Pulmonary-vein isolation was superior to atrioventricular-node ablation with biventricular pacing in patients with heart failure who had drug-refractory atrial fibrillation

Long-Term Anticoagulation

- CHADS Score
- Guidelines

Risk Factors	Relative Risk
Previous stroke or TIA	2.5
Diabetes mellitus	1.7
History of hypertension	1.6
Heart failure	1.4
Advanced age (continuous, per decade)	1.4

TABLE 9. Stroke Risk in Patients With Nonvalvular AF Not Treated With Anticoagulation According to the $CHADS_2$ Index

$CHADS_2$ Risk Criteria	Score
Prior stroke or TIA	2
Age >75 y	1
Hypertension	1
Diabetes mellitus	1
Heart failure	1

Patients (N=1733)	Adjusted Stroke Rate (%/y)* (95% CI)	$CHADS_2$ Score
120	1.9 (1.2 to 3.0)	0
463	2.8 (2.0 to 3.8)	1
523	4.0 (3.1 to 5.1)	2
337	5.9 (4.6 to 7.3)	3
220	8.5 (6.3 to 11.1)	4
65	12.5 (8.2 to 17.5)	5
5	18.2 (10.5 to 27.4)	6

TABLE 10. Antithrombotic Therapy for Patients With Atrial Fibrillation

Risk Category	Recommended Therapy
No risk factors	Aspirin, 81 to 325 mg daily
One moderate-risk factor	Aspirin, 81 to 325 mg daily, or warfarin (INR 2.0 to 3.0, target 2.5)
Any high-risk factor or more than 1 moderate-risk factor	Warfarin (INR 2.0 to 3.0, target 2.5)*

Less Validated or Weaker Risk Factors	Moderate-Risk Factors	High-Risk Factors
Female gender	Age greater than or equal to 75 y	Previous stroke, TIA or embolism
Age 65 to 74 y	Hypertension	Mitral stenosis
Coronary artery disease	Heart failure	Prosthetic heart valve*
Thyrotoxicosis	LV ejection fraction 35% or less	
	Diabetes mellitus	

Ablation of Atrial Fibrillation

AF ablation guidelines HRS/EHRA 2007

- “Catheter ablation of AF in general should not be considered as first line

therapy. There is a consensus among the Task Force that the primary indication for catheter AF ablation is the presence of symptomatic AF refractory or intolerant to at least one Class 1 or 3 antI- arrhythmic medication”

Ablation of Paroxysmal AF
Pulmonary Vein Isolation

Ablation of Paroxysmal AF
Pulmonary Vein Isolation

- Symptomatic AF refractory or intolerant to at least one Class 1 or 3 antiarrhythmic medication.
- ● In rare clinical situations, it may be appropriate to perform AF ablation as first line therapy.
- ● Selected symptomatic patients with heart failure and/or reduced ejection fraction.
- ● The presence of a LA thrombus is a contraindication to catheter ablation of AF.

NEWLY DISCOVERED ATRIAL FIBRILLATION

PAROXYSMAL

Anticoag. PRN

Rx Severe Syx

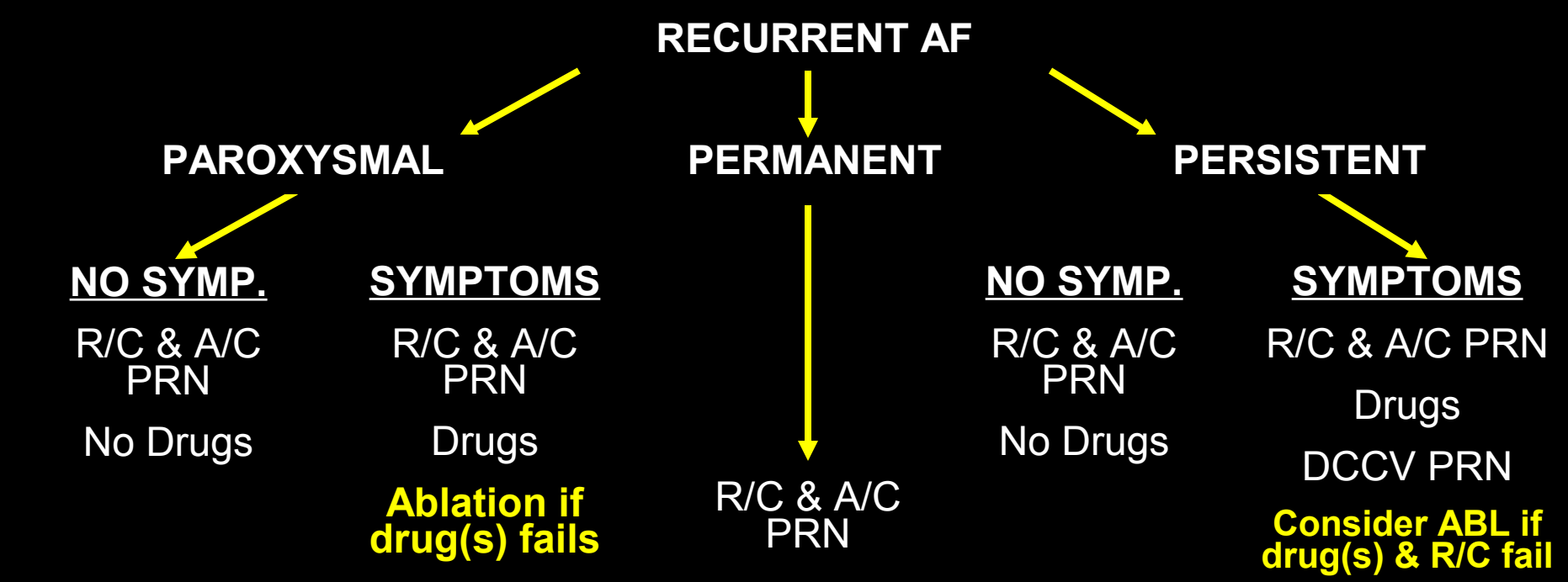
(CHF, Sync., CAD)

PERSISTENT

Rate Control & Anticoag. PRN

+/- DCCV

+/- Drugs (short-term)



ACC/AHA/ESC 2006 Guidelines for the Management of Patients With Atrial Fibrillation. JACC.2006;48

Approach in Permant and Persistent AF

- PVI
- Substrate Modification: Roof line, Posterior Wall Line, Mitral Line, CS Isolation
- CFAE- Complex Fractionated Atrial Electrogra,s
- Parasympathetic Ganglia Ablation

SPONTANEOUS INITIATION OF ATRIAL FIBRILLATION BY ECTOPIC BEATS ORIGINATING IN THE PULMONARY VEINS

MICHEL HAÏSSAGUERRE, M.D., PIERRE JAÏS, M.D., DIPEN C. SHAH, M.D., ATSUSHI TAKAHASHI, M.D., MÉLÈZE HOCINI, M.D., GILLES QUINIOU, M.D., STÉPHANE GARRIGUE, M.D., ALAIN LE MOUROUX, M.D., PHILIPPE LE MÉTAYER, M.D., AND JACQUES CLÉMENTY, M.D.

N Engl J Med 1998;339:659-66

- 45 pts with drug-ref PAF (6h/d)
- Initiation of AF was mapped by recording the earliest electrical activity preceding the onset
- **94%** of foci were in PVs
- During a follow-up period of 8±6 months after ablation, 62% had no AF recurrence

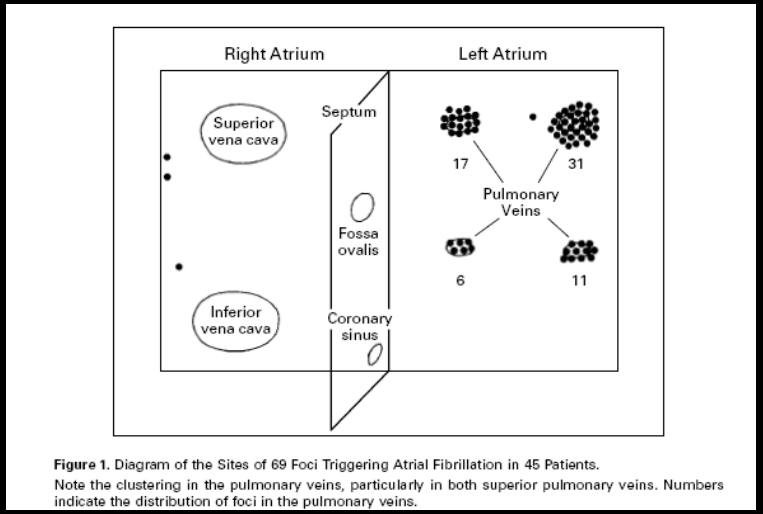
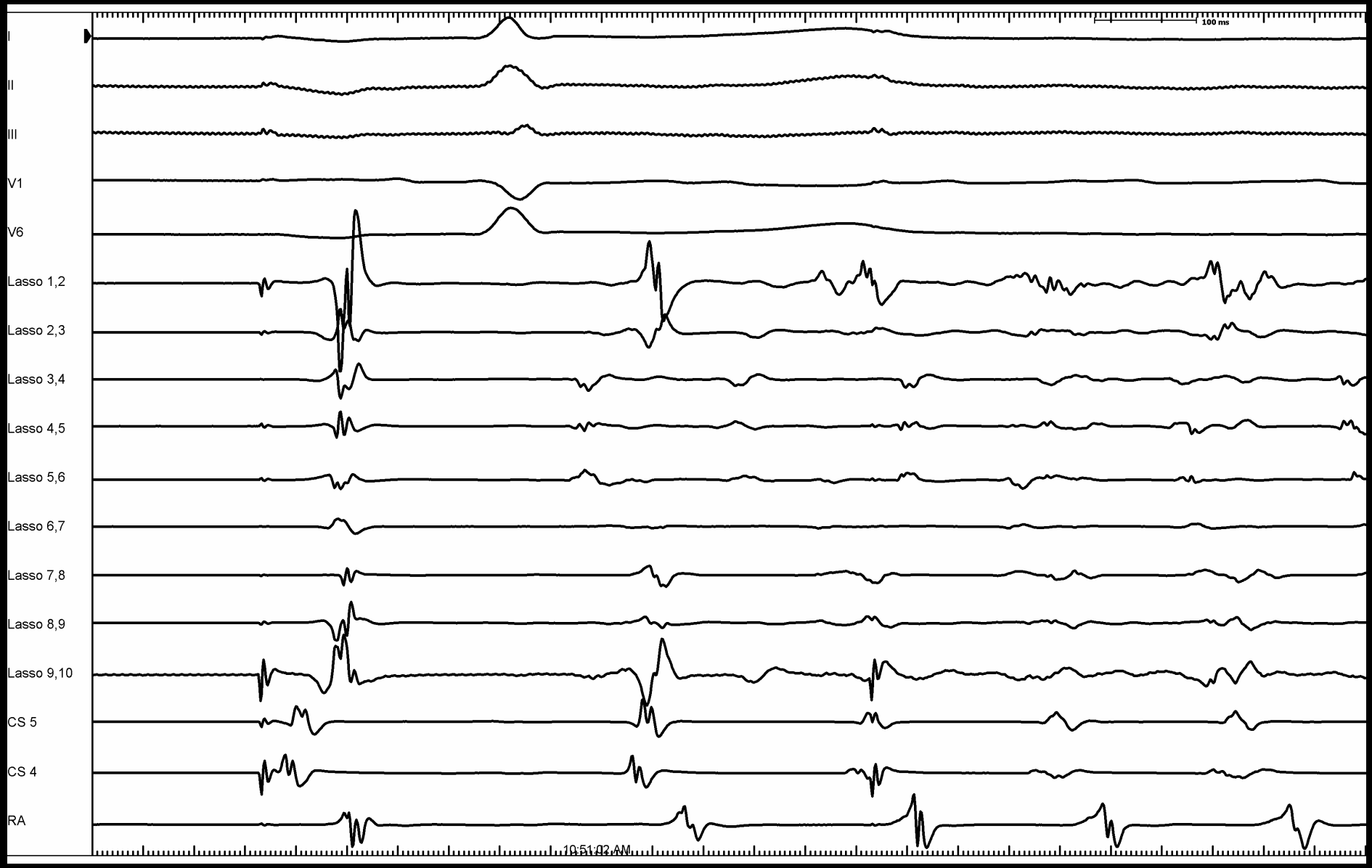


Figure 1. Diagram of the Sites of 69 Foci Triggering Atrial Fibrillation in 45 Patients.
Note the clustering in the pulmonary veins, particularly in both superior pulmonary veins. Numbers indicate the distribution of foci in the pulmonary veins.

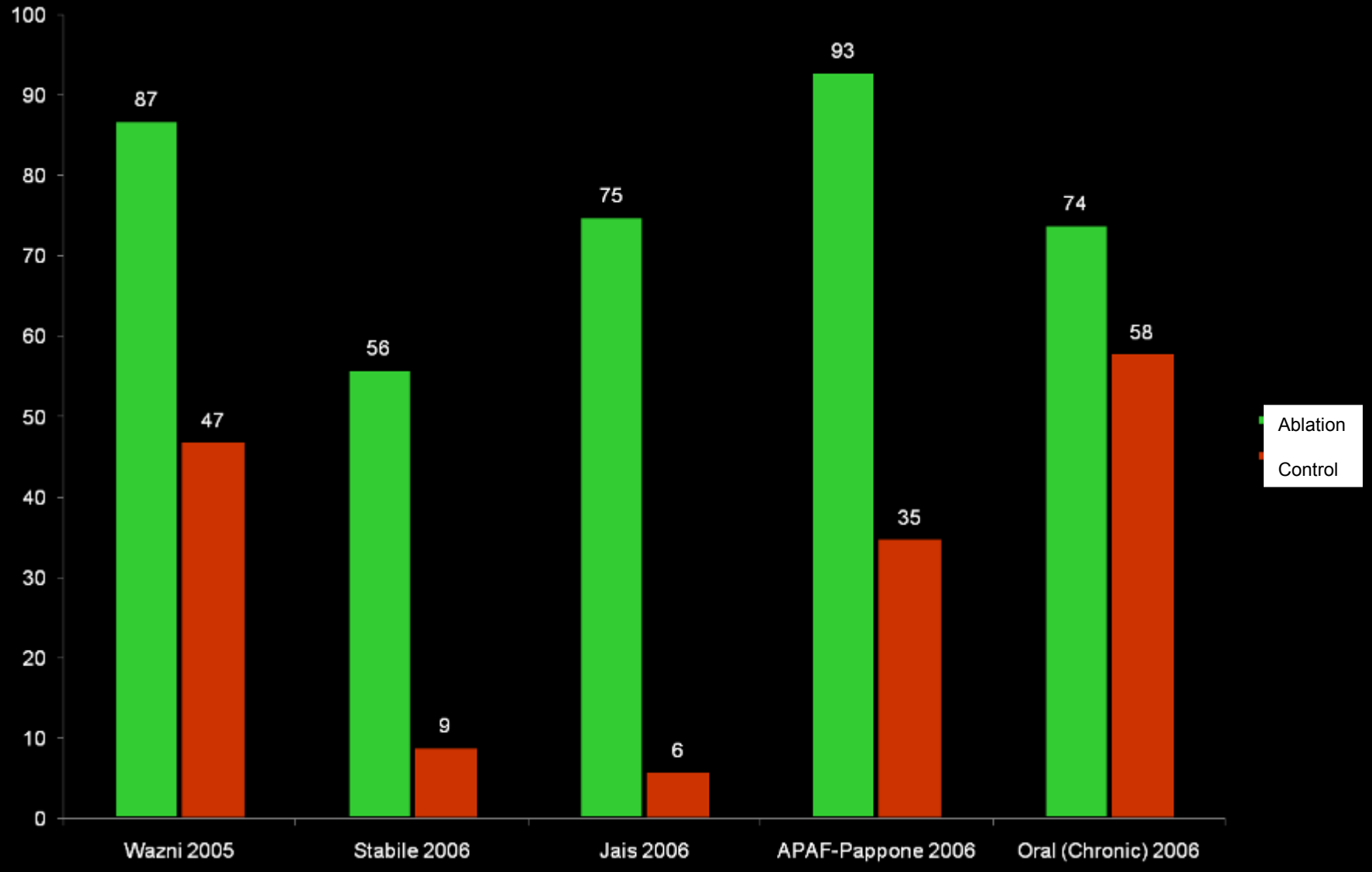
During CS pacing what happens?



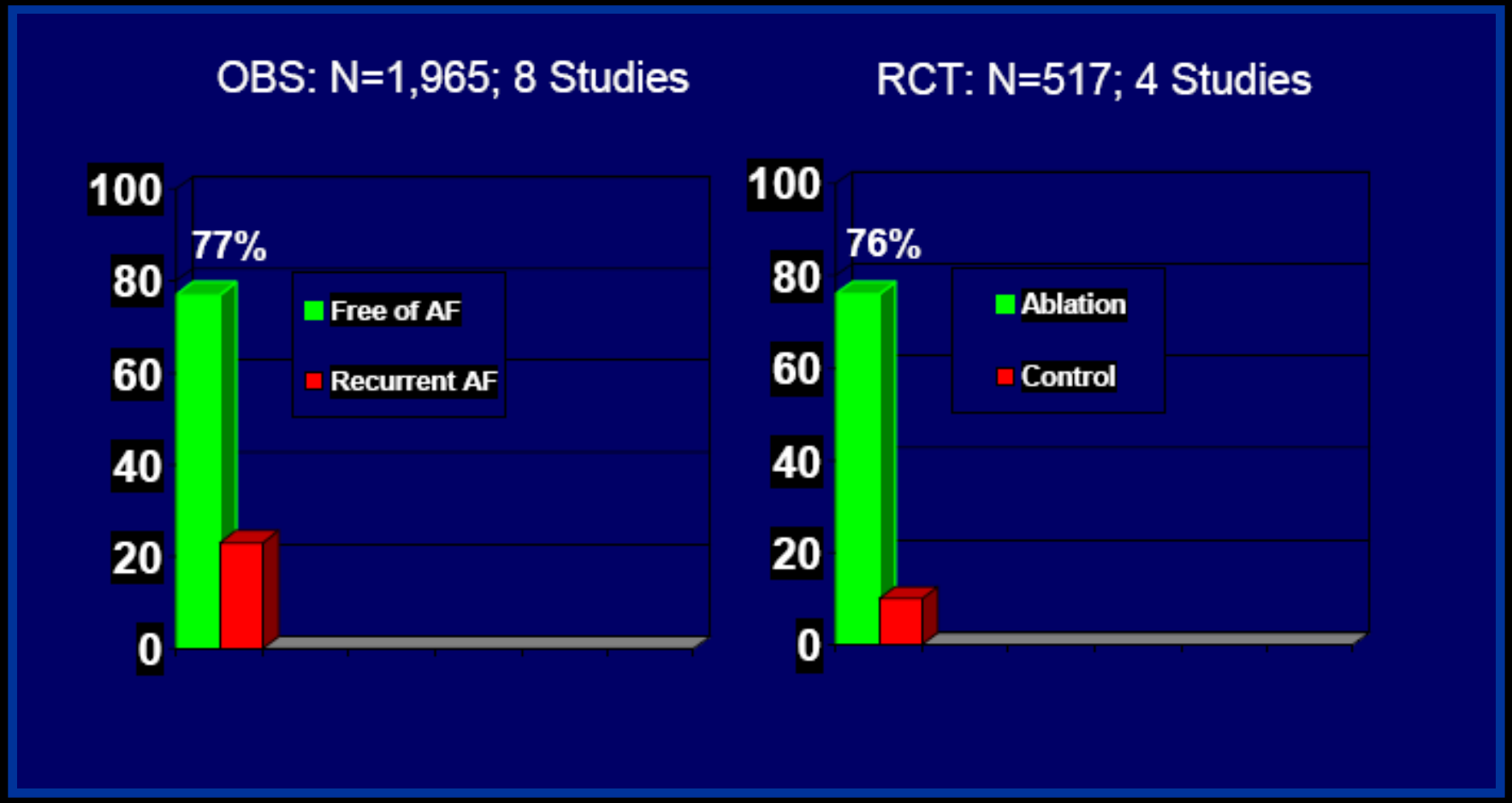
Success Rates in RCTs

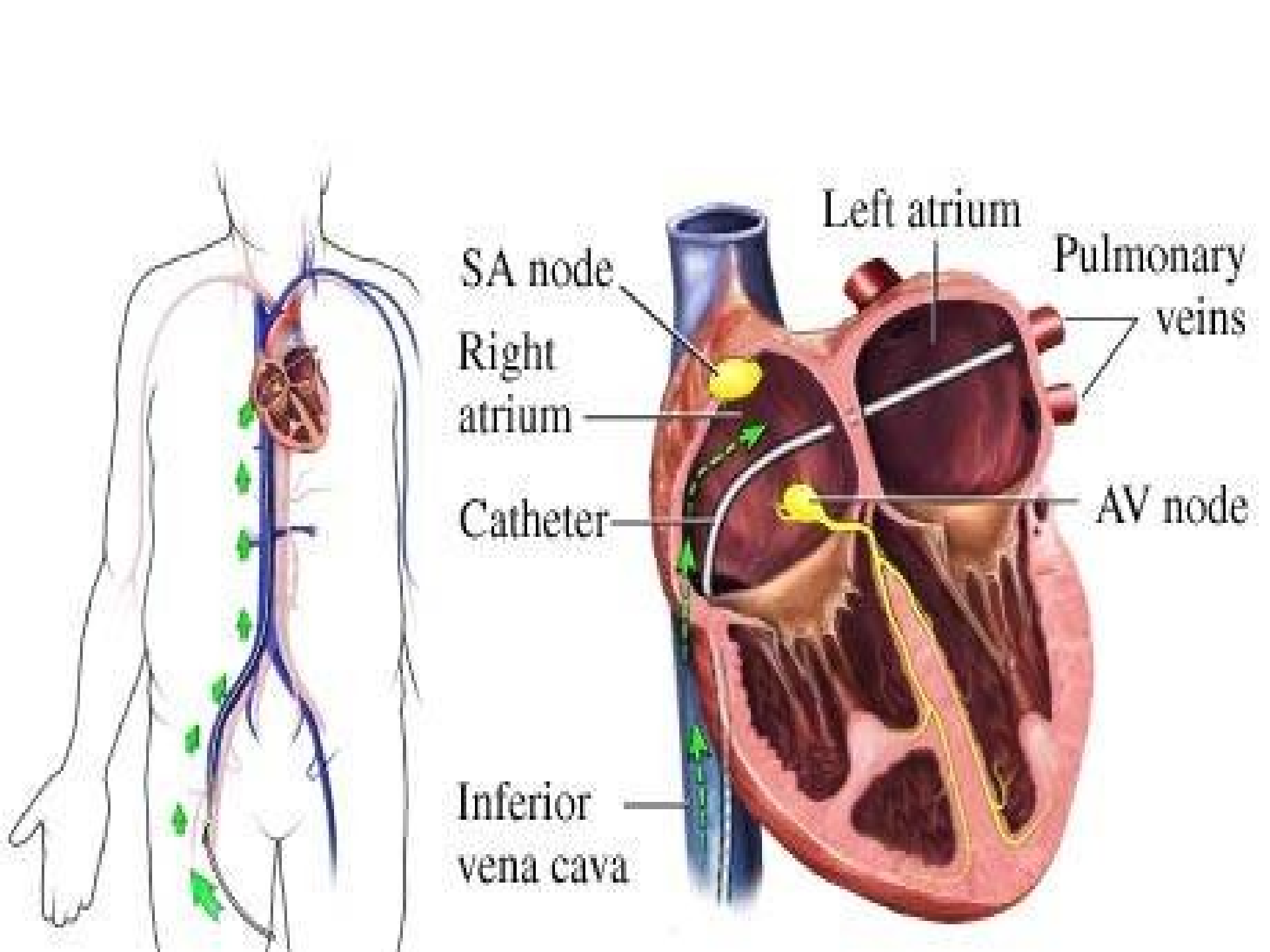
STUDY (year)	Population	Design	N	12 mo. Success (%)
Jais HRS (2006)	Paroxysmal	ABL v. AAD (flec or sotal)	112	75 v. 6
Pappone APAF JACC (2006)	Paroxysmal or persistent	ABL v. AAD	198	93 v. 35
Stabile CACAF. EHJ (2006)	Paroxysmal or persistent (1/3)	AAD +/- ABL	137	56 v. 9
Wazni RAAFT. JAMA (2005)	Paroxysmal	ABL v. AAD	70	87 v. 47 *(symptomatic)*
Oral, Pappone NEJM (2006)	Persistent	Amio + 2 DCCV in 1st 3 mos. **+/- CPVA**, amio x 3 mos. post	146	74 v. 58 (4)

12 month %AF Free in RCTs

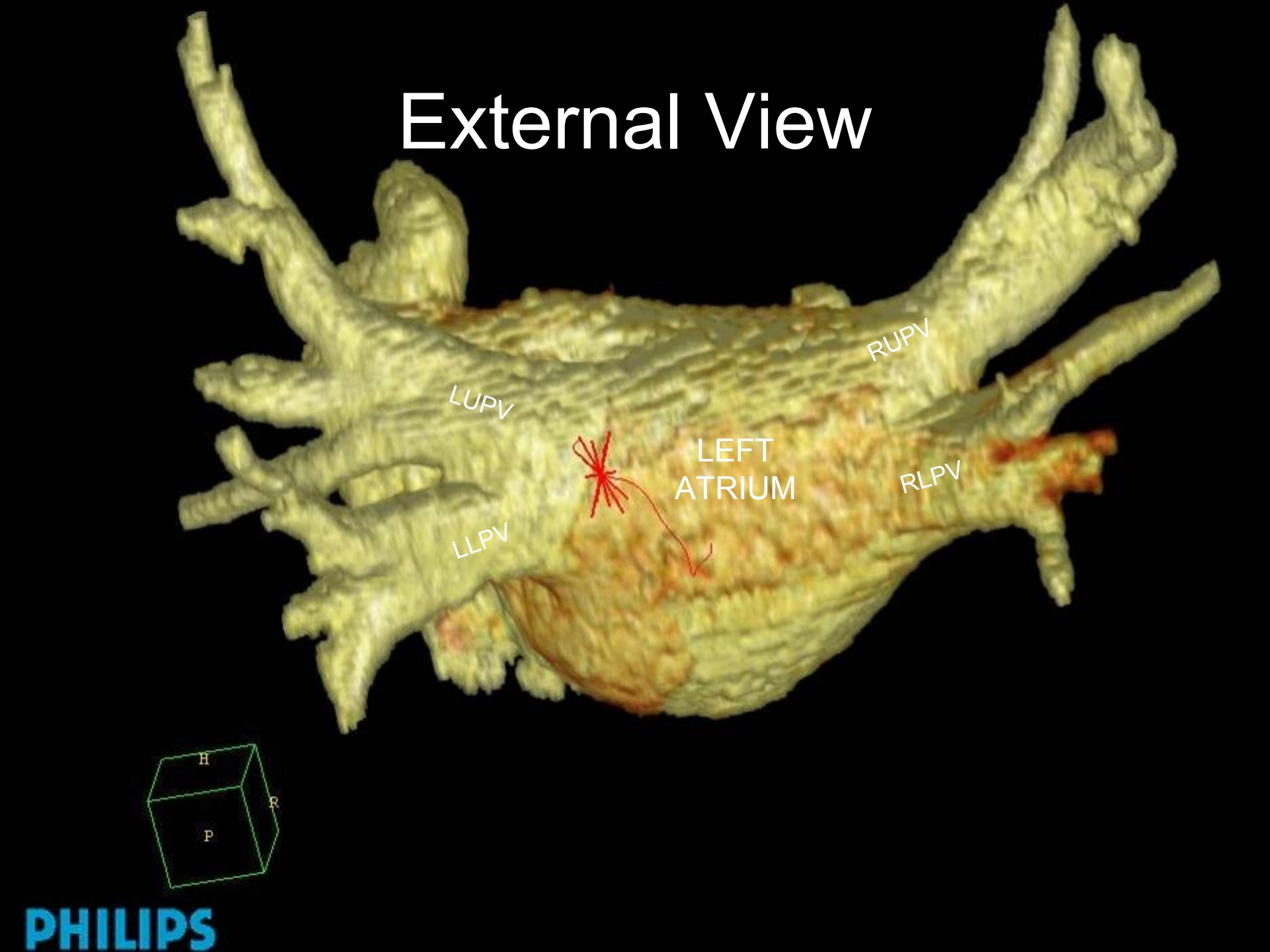


Trials of AF Ablation:
% Free of AF at 12 months



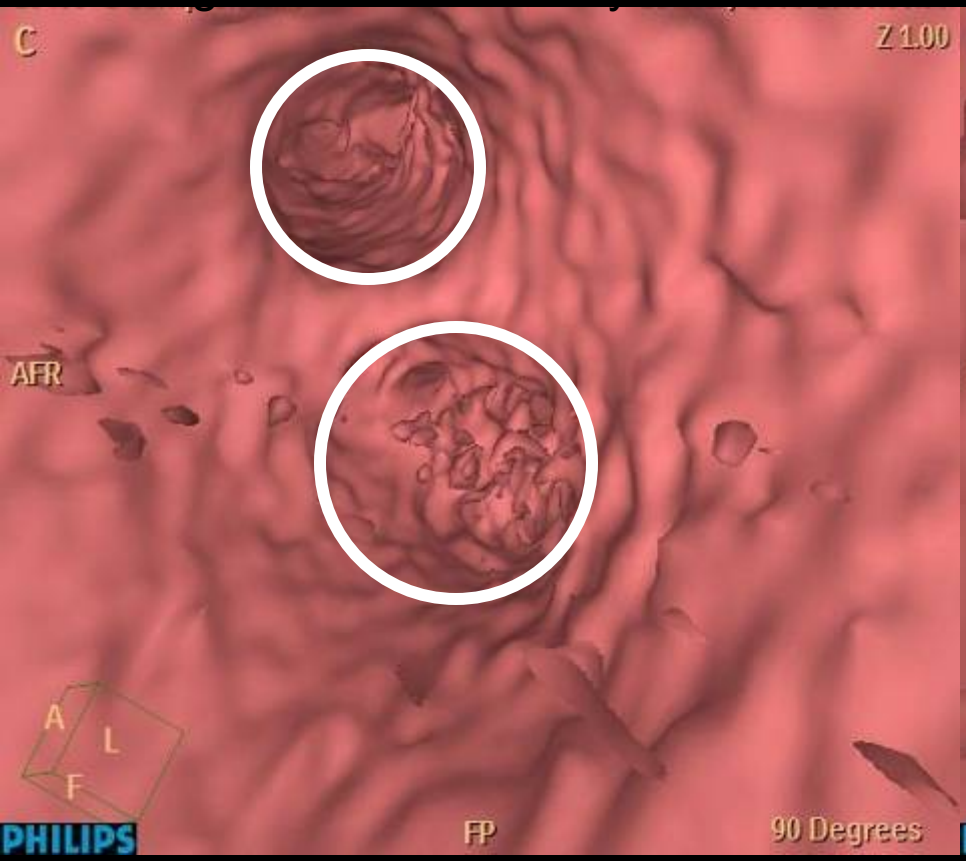

Left atrium
SA node
Pulmonary veins
Right atrium
Catheter
AV node
Inferior vena cava

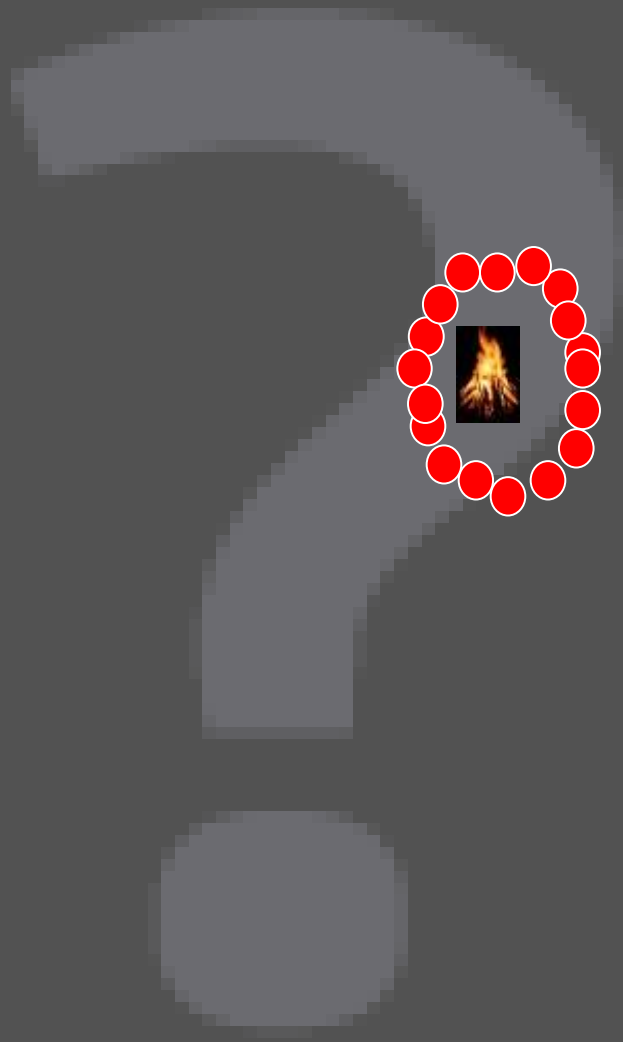
External View



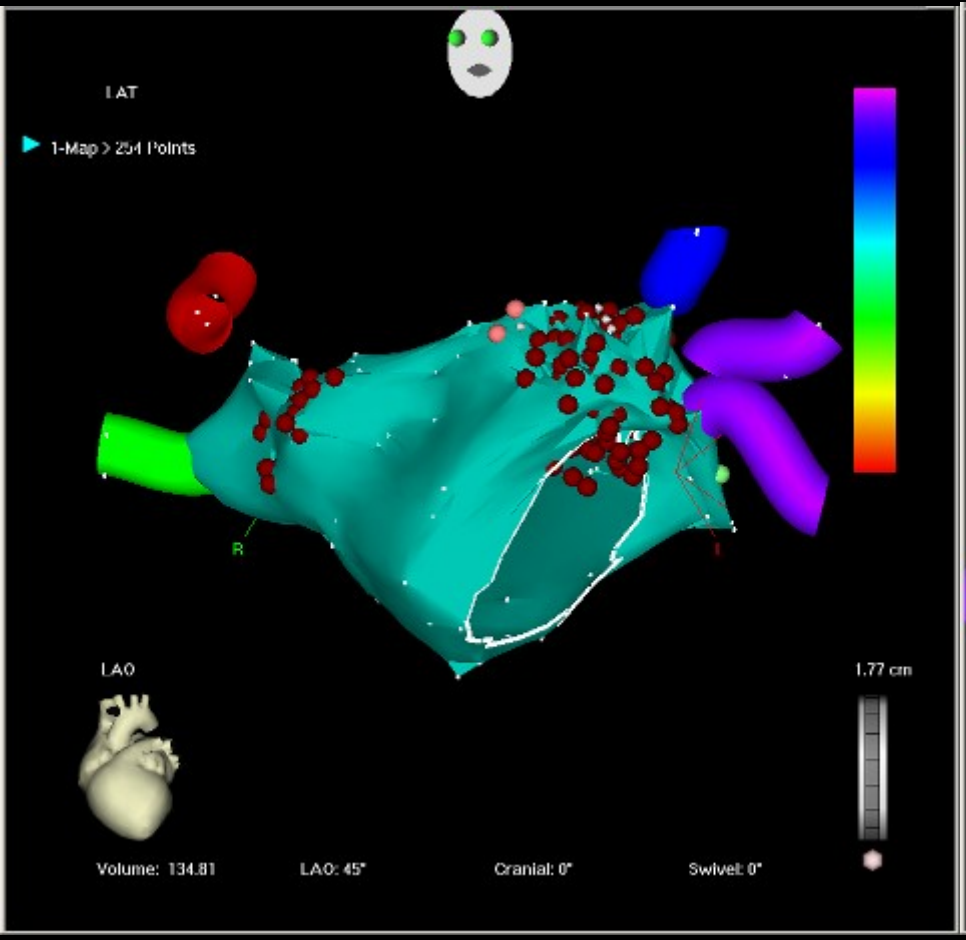
PHILIPS

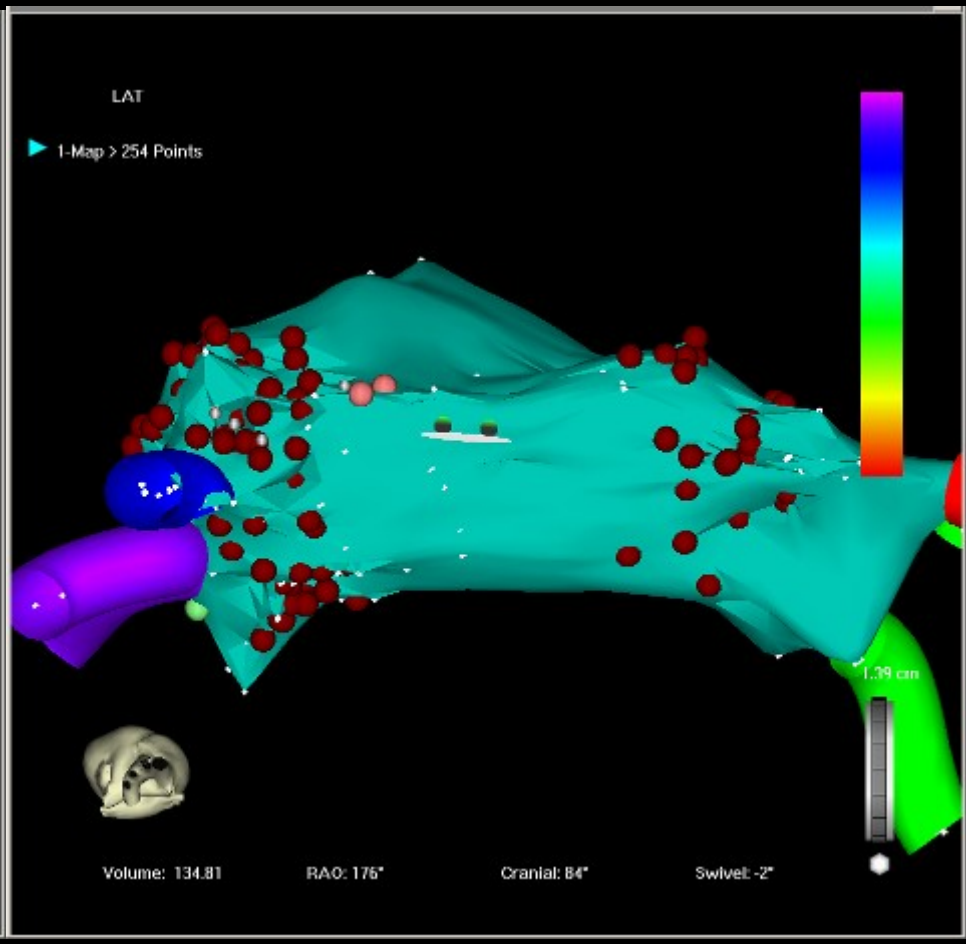
Internal View

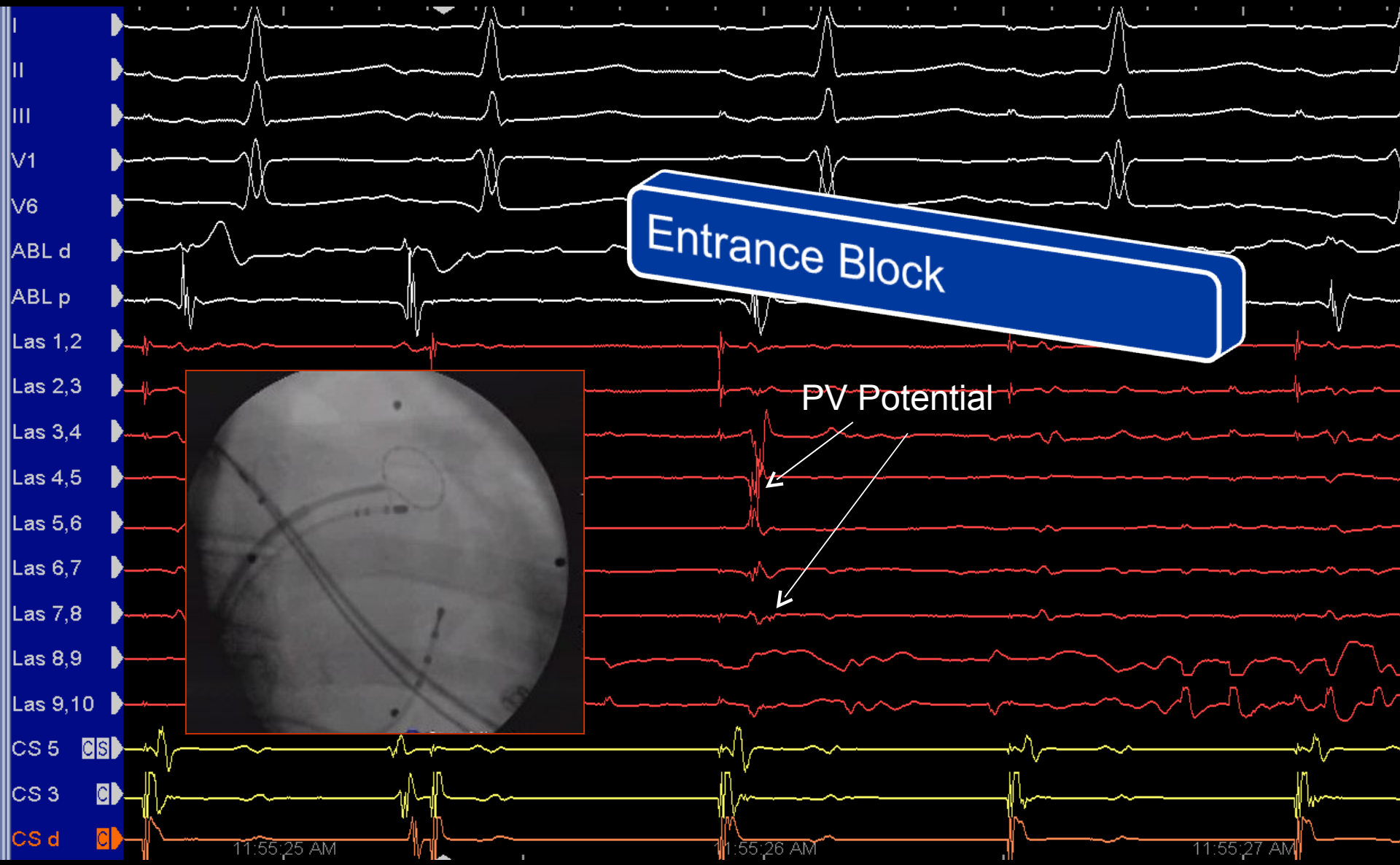




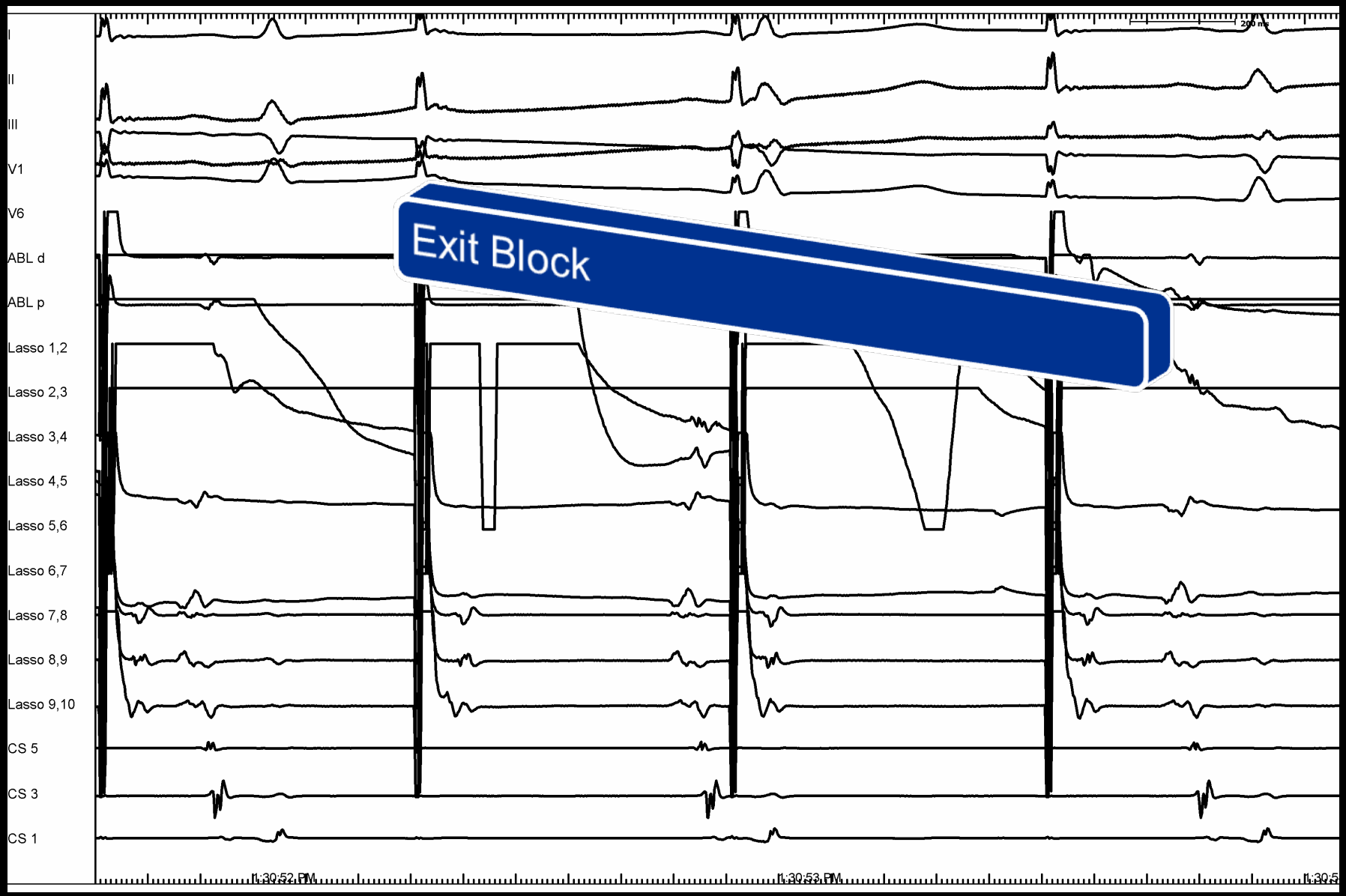
Courtesy of David Callans, MD


LAT
1-Map > 254 Points
R
LAO
1.77 cm
Volume: 134.81
LAO: 45°
Cranial: 0°
Swivel: 0°

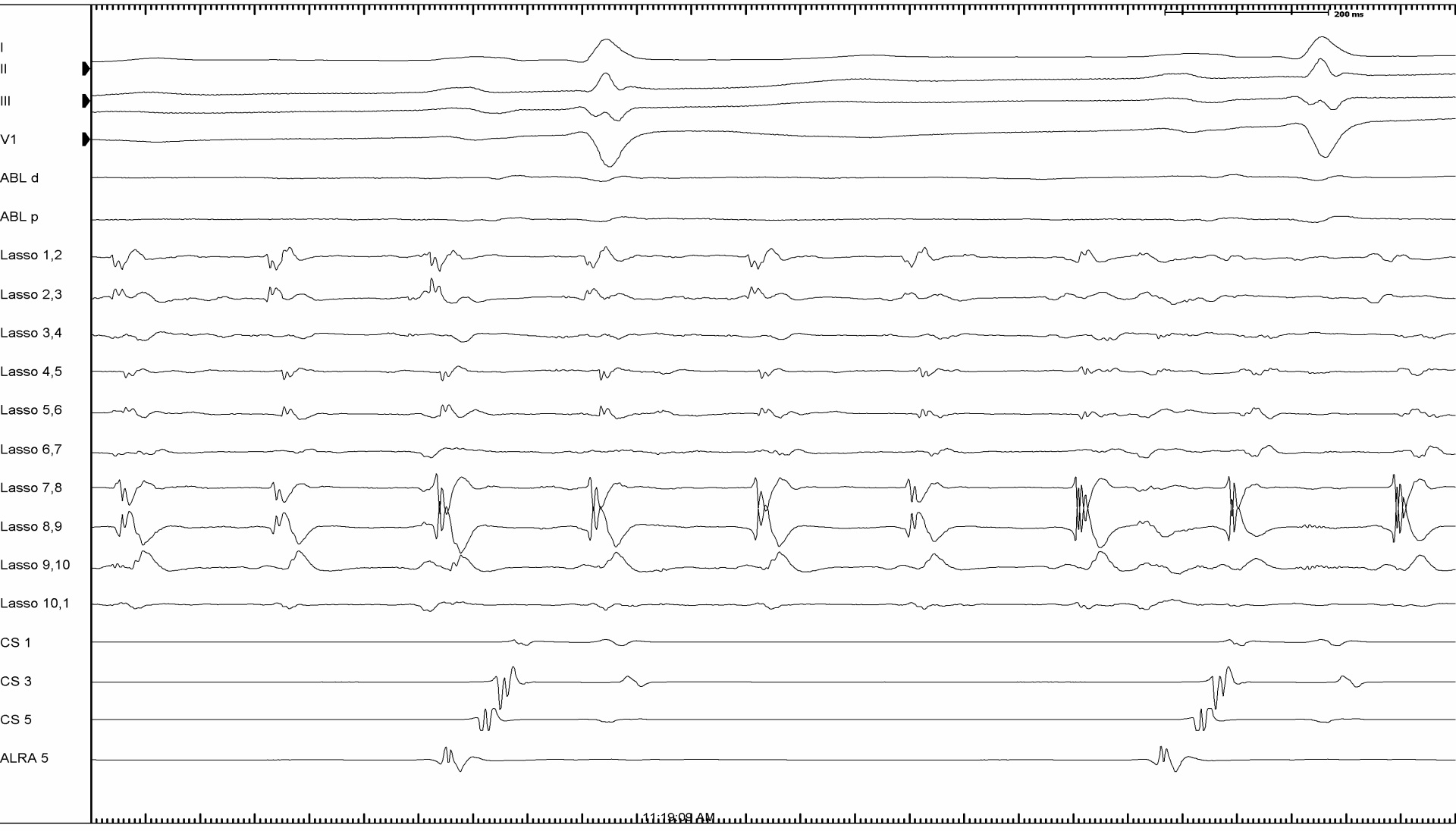

LAT
1-Map > 254 Points
1.39 cm
Volume: 134.81
RAO: 176°
Cranial: 84°
Swivel: -2°

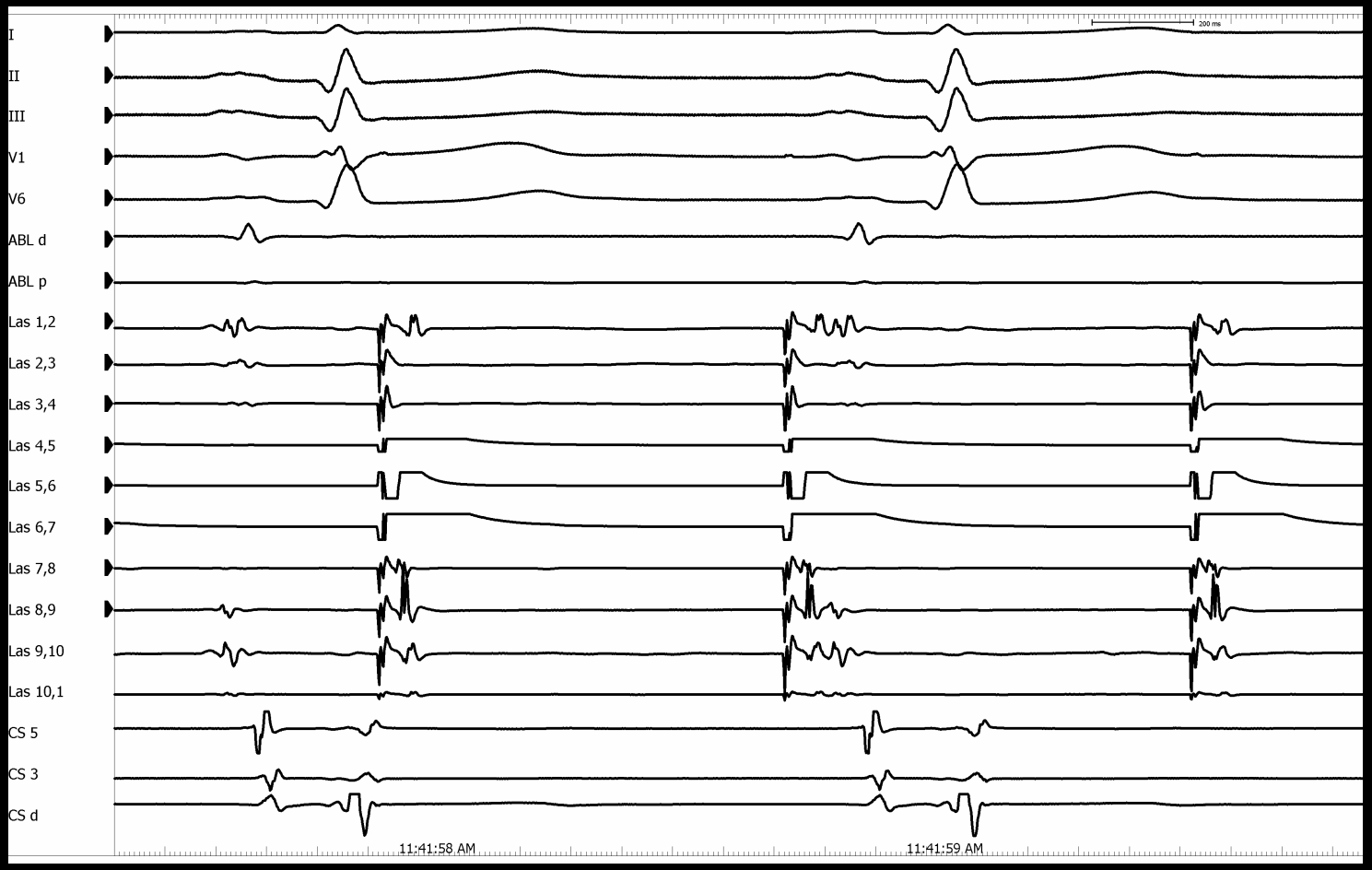

I
II
III
V1
V6
ABL d
ABL p
Las 1,2
Las 2,3
Las 3,4
Las 4,5
Las 5,6
Las 6,7
Las 7,8
Las 8,9
Las 9,10
CS 5
CS 3
CS d
Entrance Block
PV Potential
11:55:25 AM
11:55:26 AM
11:55:27 AM

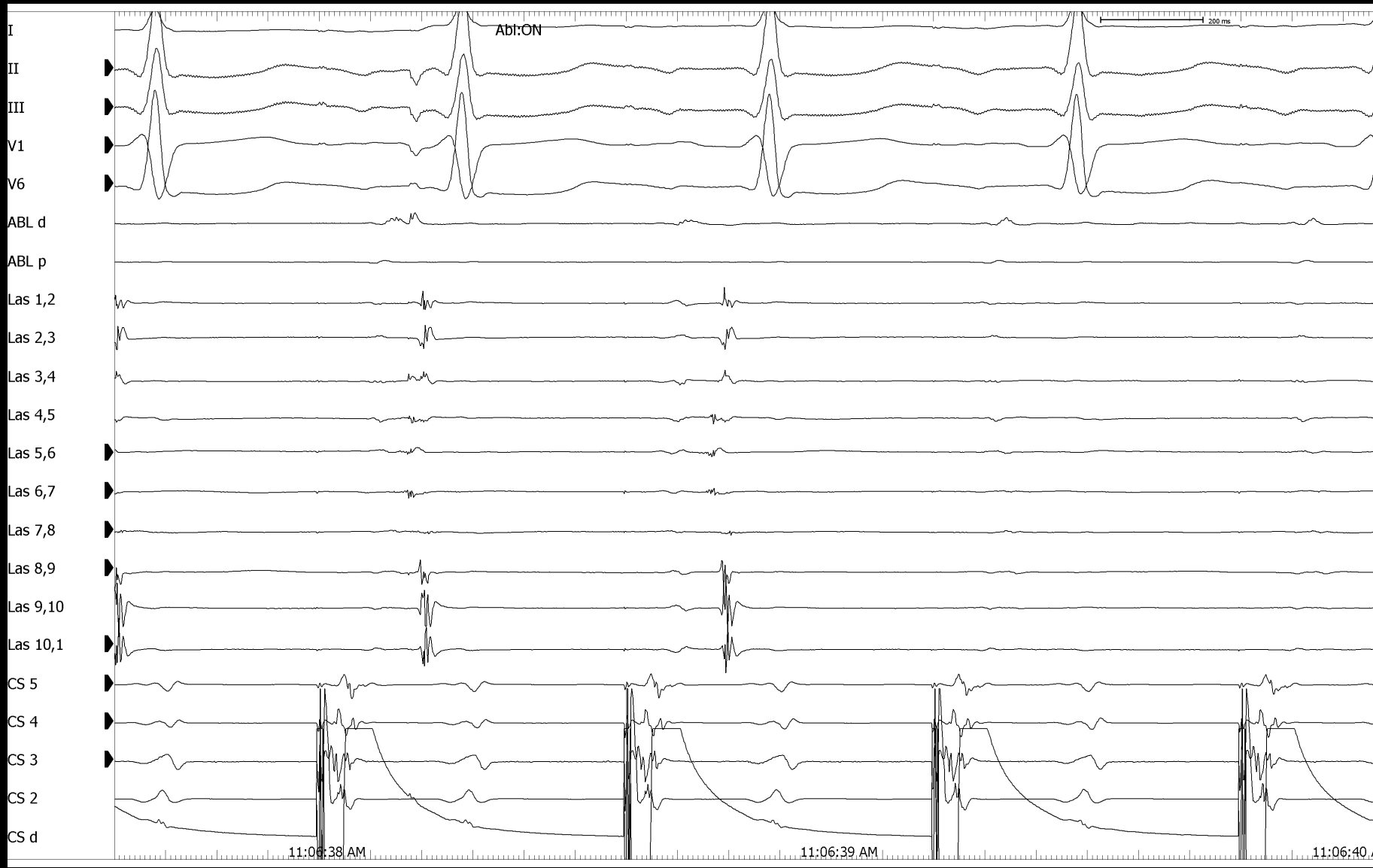
What does lasso pacing show?



AF ablation are we done?




I
II
III
V1
V6
ABL d
ABL p
Las 1,2
Las 2,3
Las 3,4
Las 4,5
Las 5,6
Las 6,7
Las 7,8
Las 8,9
Las 9,10
Las 10,1
CS 5
CS 3
CS d
200 ms
11:41:58 AM
11:41:59 AM


I
II
III
V1
V6
ABL d
ABL p
Las 1,2
Las 2,3
Las 3,4
Las 4,5
Las 5,6
Las 6,7
Las 7,8
Las 8,9
Las 9,10
Las 10,1
CS 5
CS 4
CS 3
CS 2
CS d
Abl:ON
200 ms
11:06:38 AM
11:06:39 AM
11:06:40

Complications of AF Ablation

- Groin Complications
  - AV Fistula
  - Pseuduaneurysm
  - Hematoma
- Pericardial Effusion/Tamponade
- LA-Esophageal Fistula
- PV Stenosis
- Stroke

A few words on atrial flutter

- Mechanism: Tricuspid dependent or not
- In general similar consideration in management re: anticoagulation
- Much lower threshold for ablation therapy
- Drugs not effective in general
- Ablation very successful in TV-IVC isthmus dependent atrial flutter (95%)

- Non –Isthmus dependent and LA flutter – requires complex EP studies and ablations