RHYTHM 2017

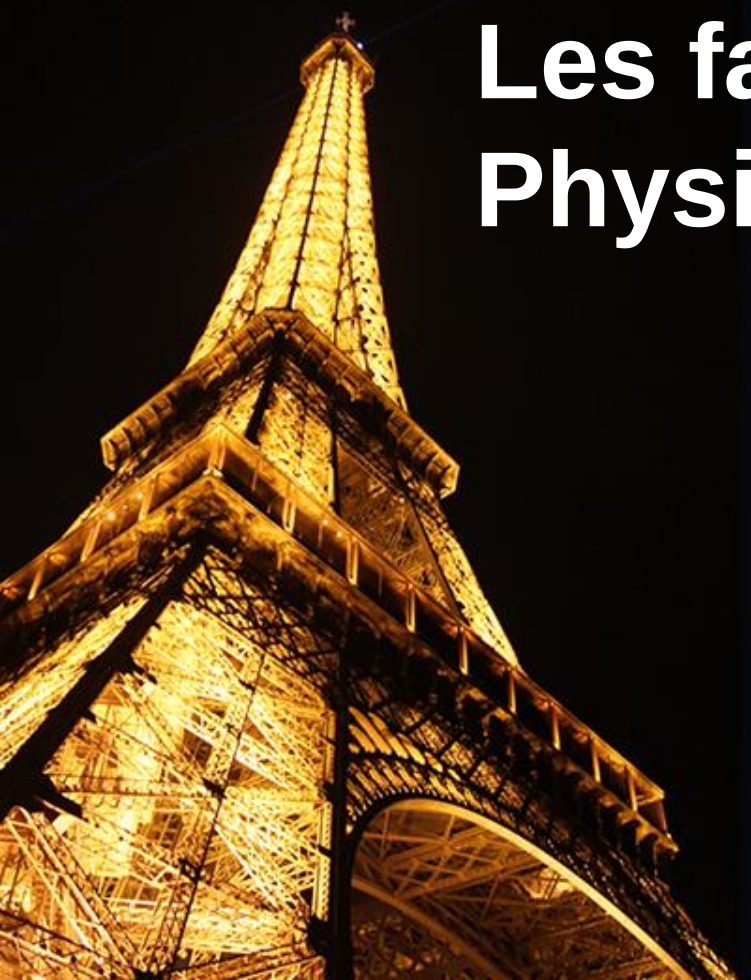
Arrhythmias & Heart Failure

New Insights & Technological Advances

March 2-3

9th Congress Edition

Novotel PARIS Tour Eiffel



Les faisceaux de Kent: Physiopathologie, ablation

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Disclosures

Dr Franck Halimi

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I have the following potential conflicts of interest to report:

Consulting:

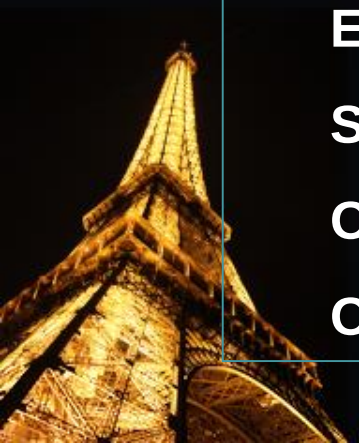
- Medtronic, Saint Jude Medical, Boston Scientific, Biotronik, Johnson & Johnson

Employment in industry: 0

Shareholder in a healthcare company: 0

Owner of a healthcare company: 0

Other(s): 0

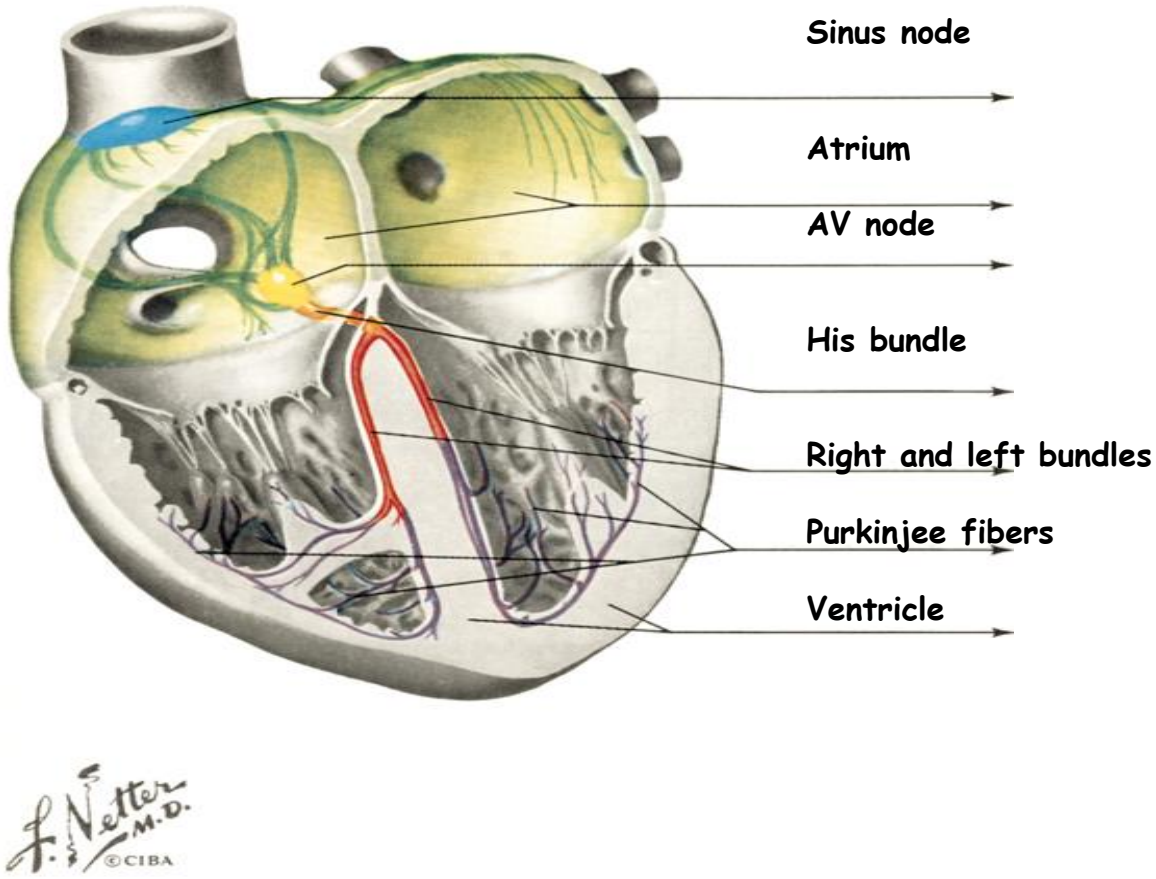


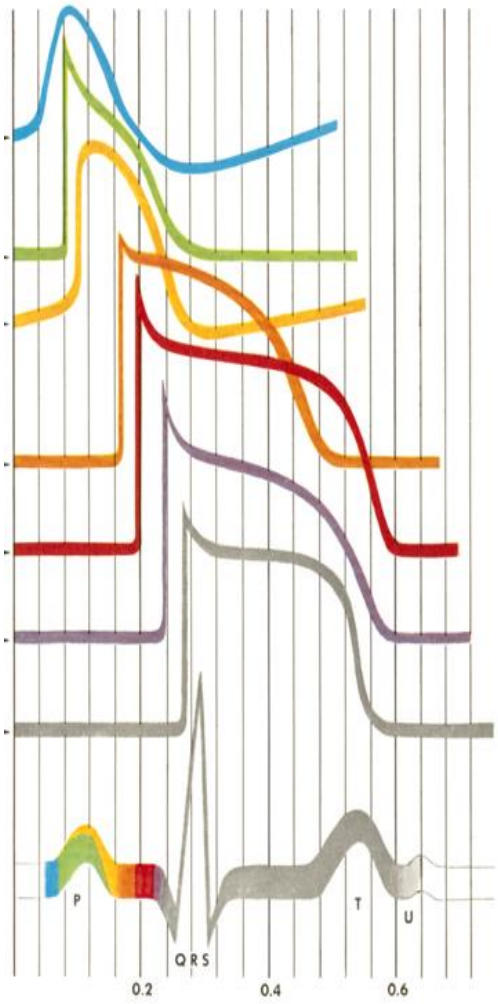
Definitions

- Reciprocating tachycardias are involving the AV junction

- AVRT: Reciprocating tachycardias using an accessory atrioventricular pathway
  - Kent bundle (WPW +/-)
  - Mahaïm fibers
  - PJRT

The Normal Conduction System

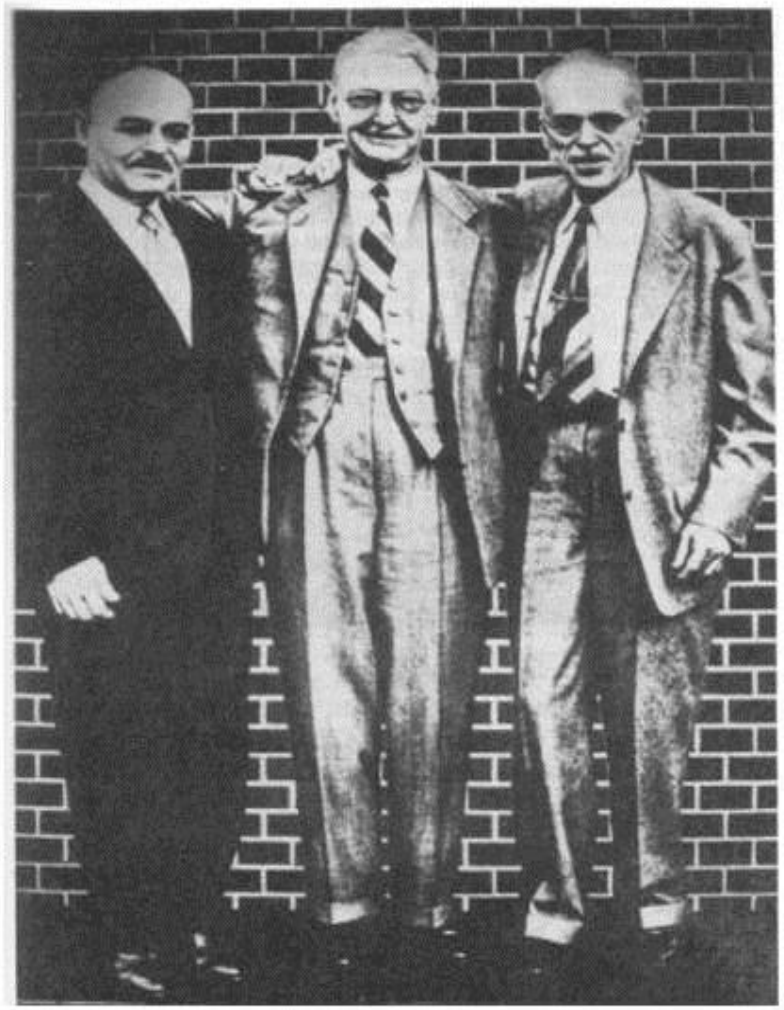




ST. JUDE MEDICAL
MORE CONTROL. LESS RISK.

« Mr Wolff Parkinson and White »

Louis Wolff
John Parkinson
Paul D White



Am Heart J 1930; 5: 549-555

AVRT « Wolff-Parkinson-White Syndrome »

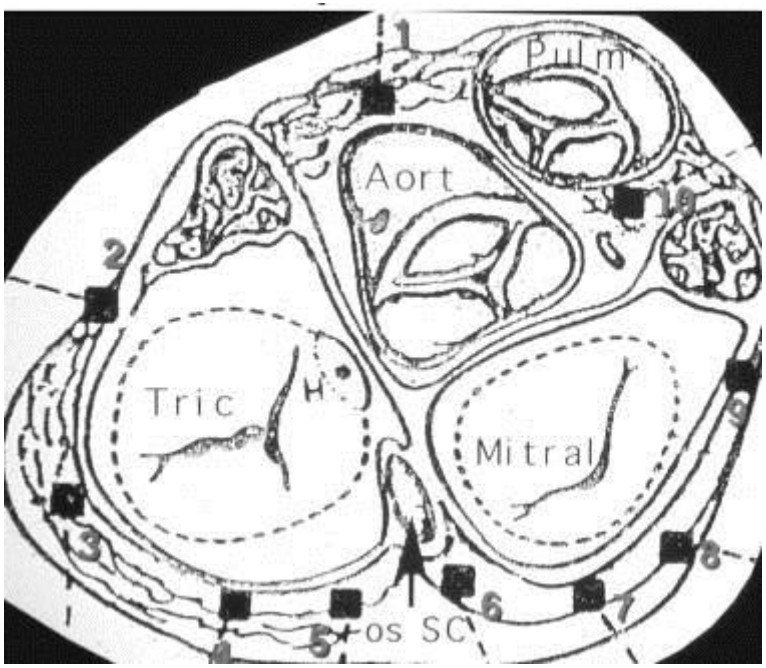
- Kent accessory pathways are muscular fibers connecting the atrium and the ventricle around the MA and TA
- WPW syndrome:
  - Association of a preexcitation aspect on 12 lead ECG with paroxysmal tachycardias (definition)
- Kent fibers are not always associated with a WPW syndrome
    - Manifest (overt) AP (WPW)
    - Concealed AP (no preexcitation, retrograde conduction only)
    - Masked AP (unmasked by pacing)
- Multiple APs are possible
  - Ebstein, Mahaïm + right AP, 2 left APs...

Epidemiology of WPW Syndrome

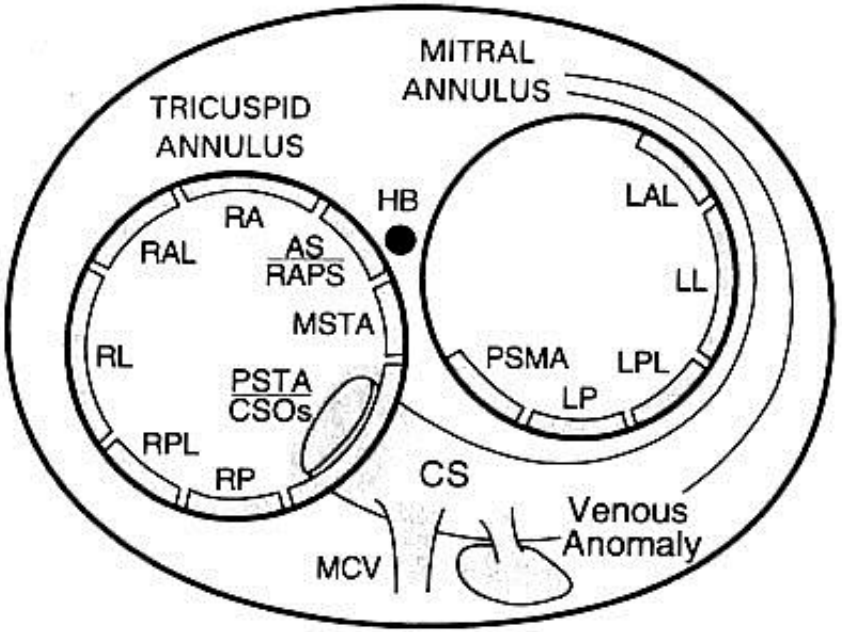
- Prevalence: 0.3% in children dropping to 0.1 in adults
- Annual incidence 4 per 100000 per yr
- Males twice as often than females
- SCD: 1.5/1000/pt/yr

Guize L, Smith RF, Hiss, Swiderski J, Munger TM

Location of accessory pathways



Gallagher J.J.



Jackman W.

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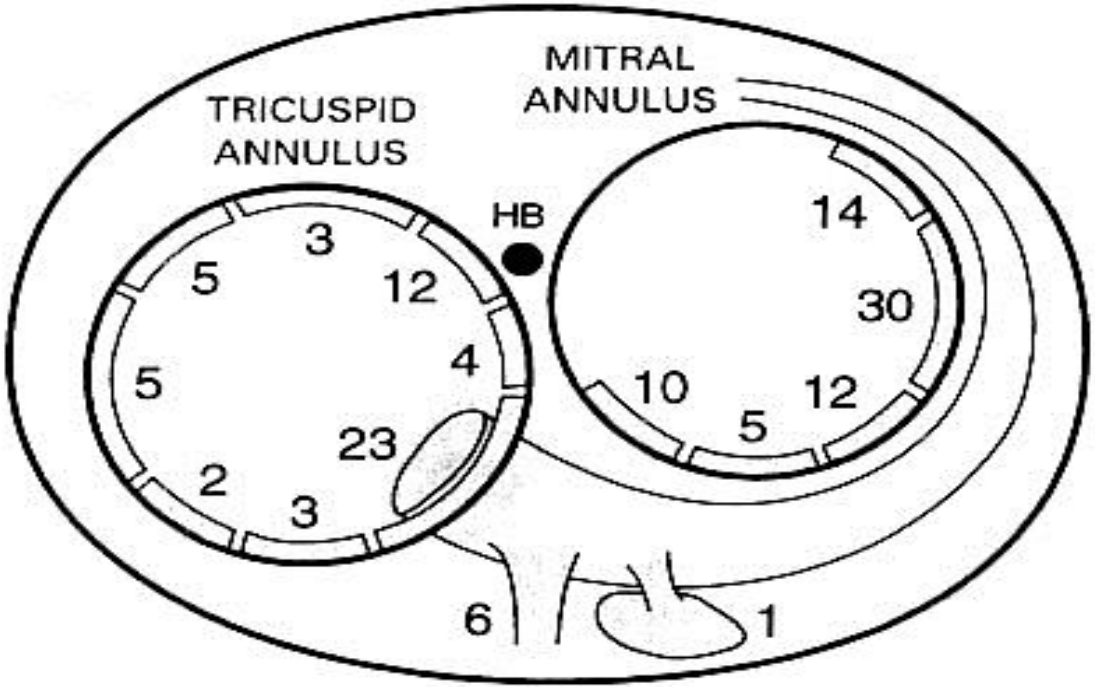
Accessory pathways distribution



Jackman W.

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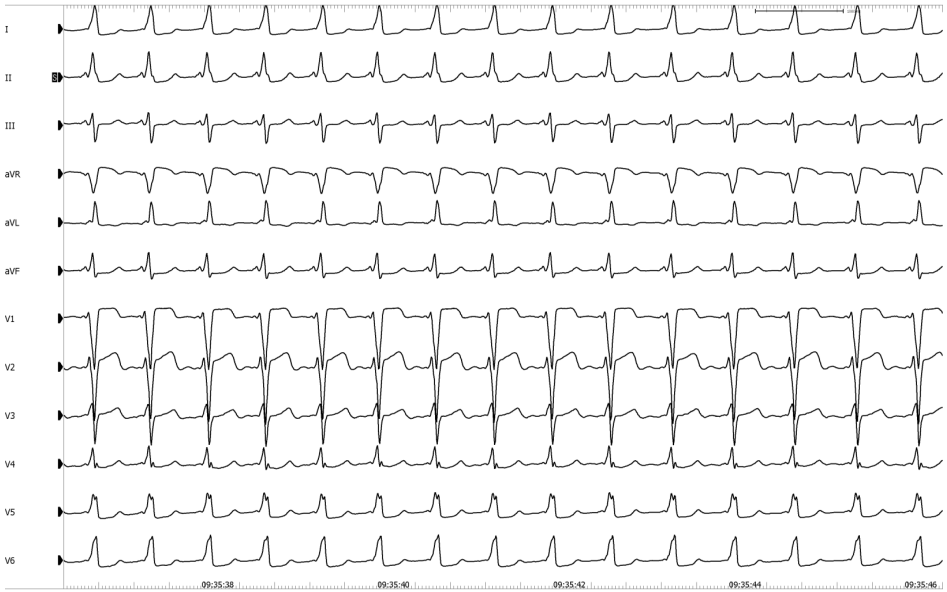
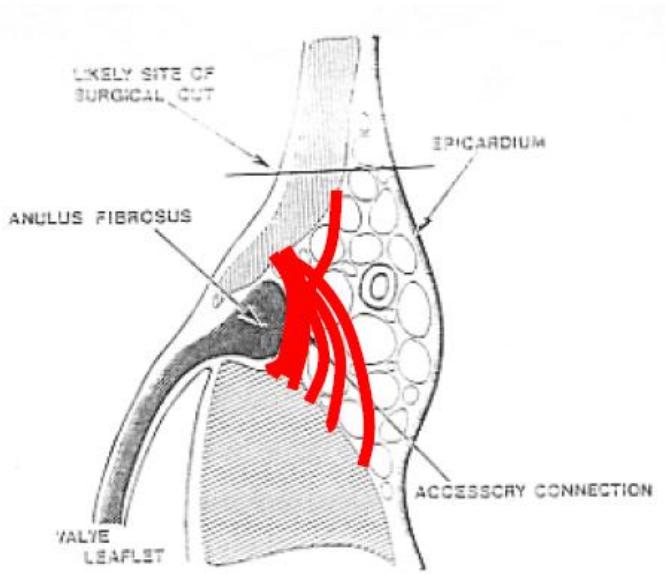
ECG pattern

- ECG
  - Short PR interval
  - Delta wave (preexcitation)
  - Atypical repolarization





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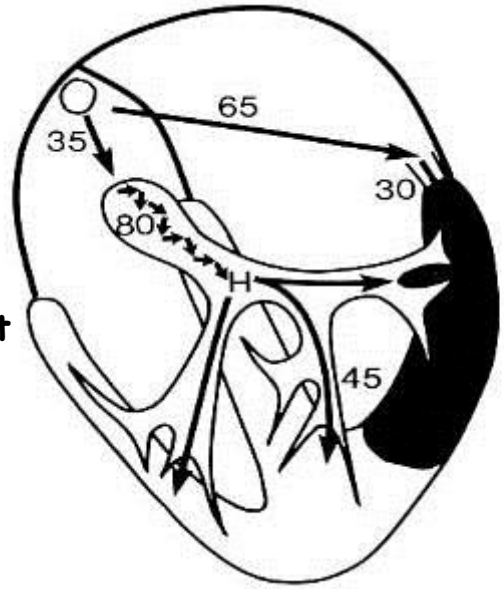
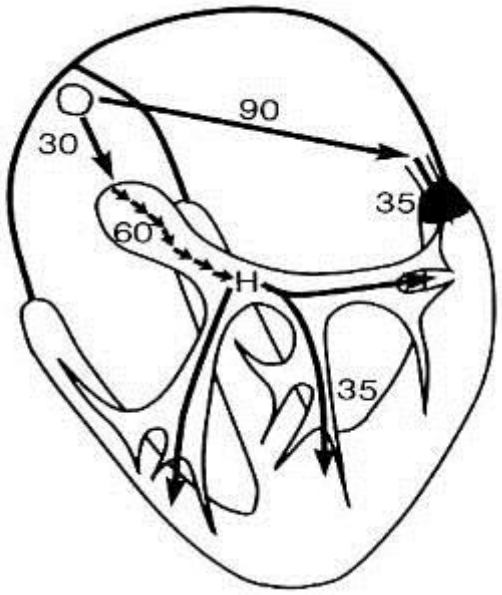
Manifest vs. masked pathways

overt

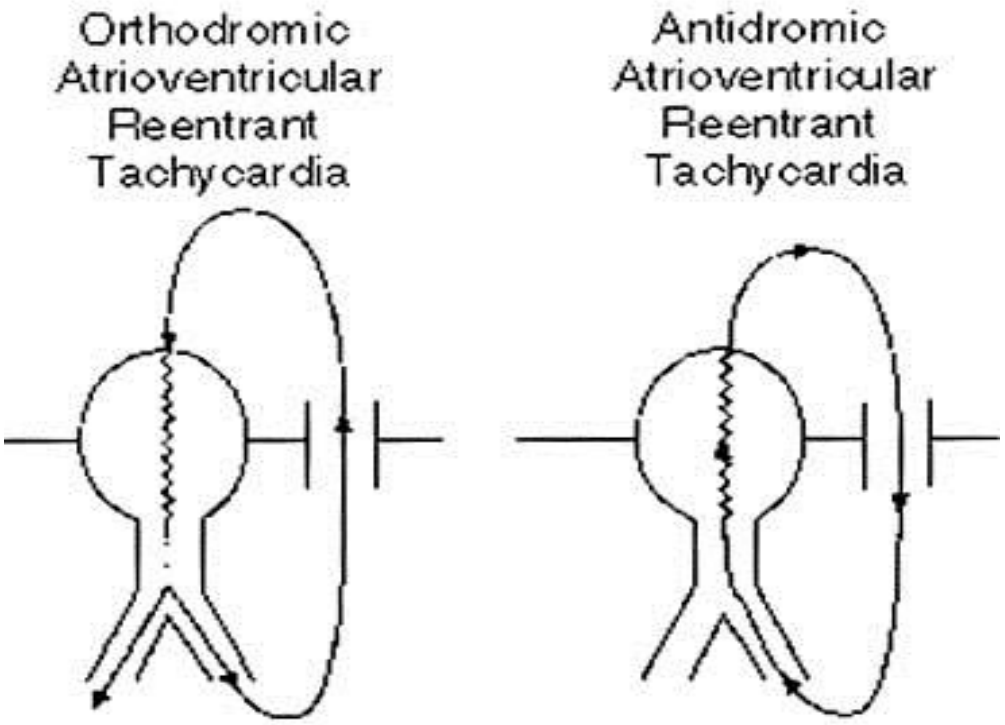




masked

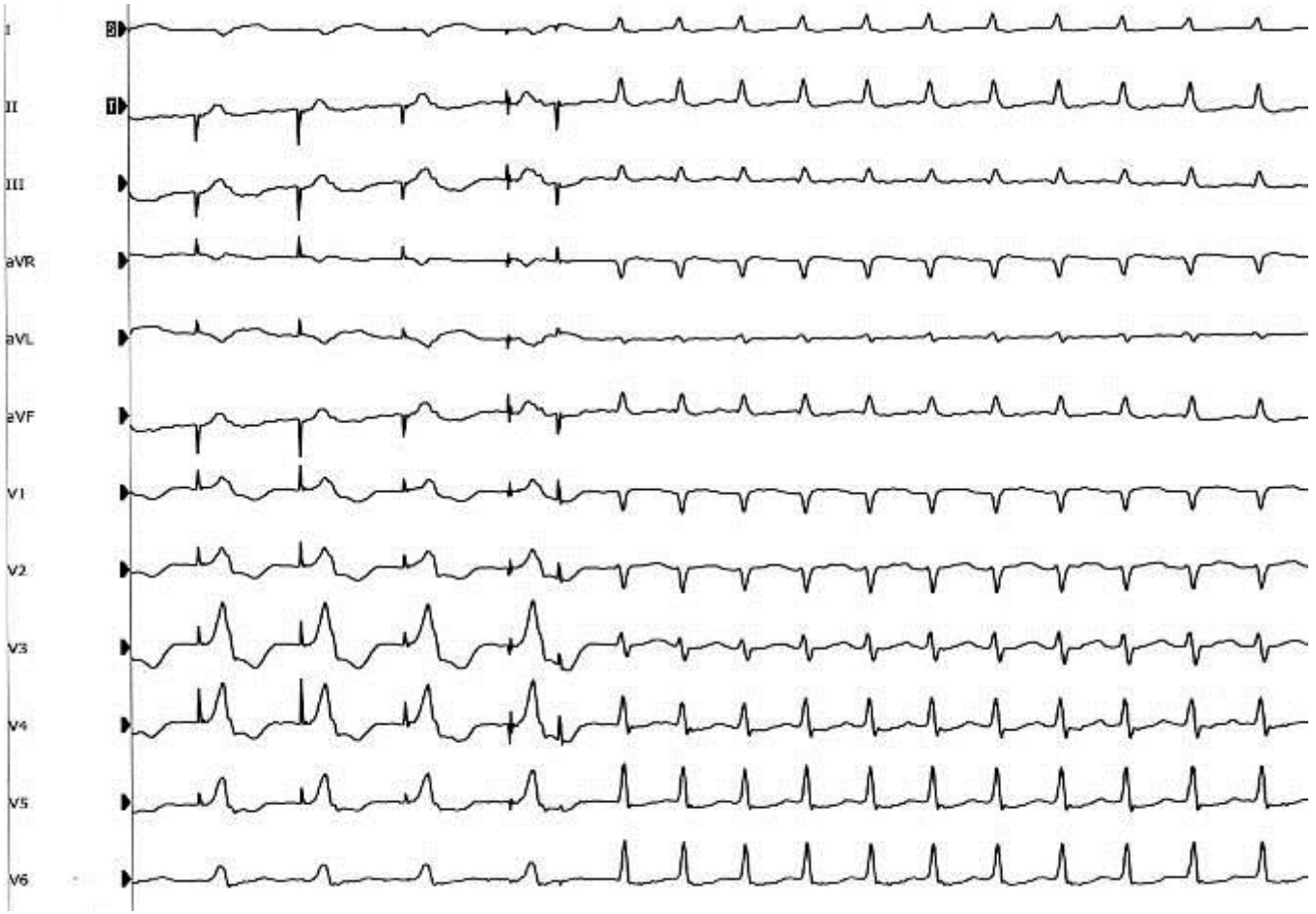
Wellens H.J.

Reciprocating tachycardia



Ganz L.I. et al.

Left lateral AP: orthodromic tachycardia



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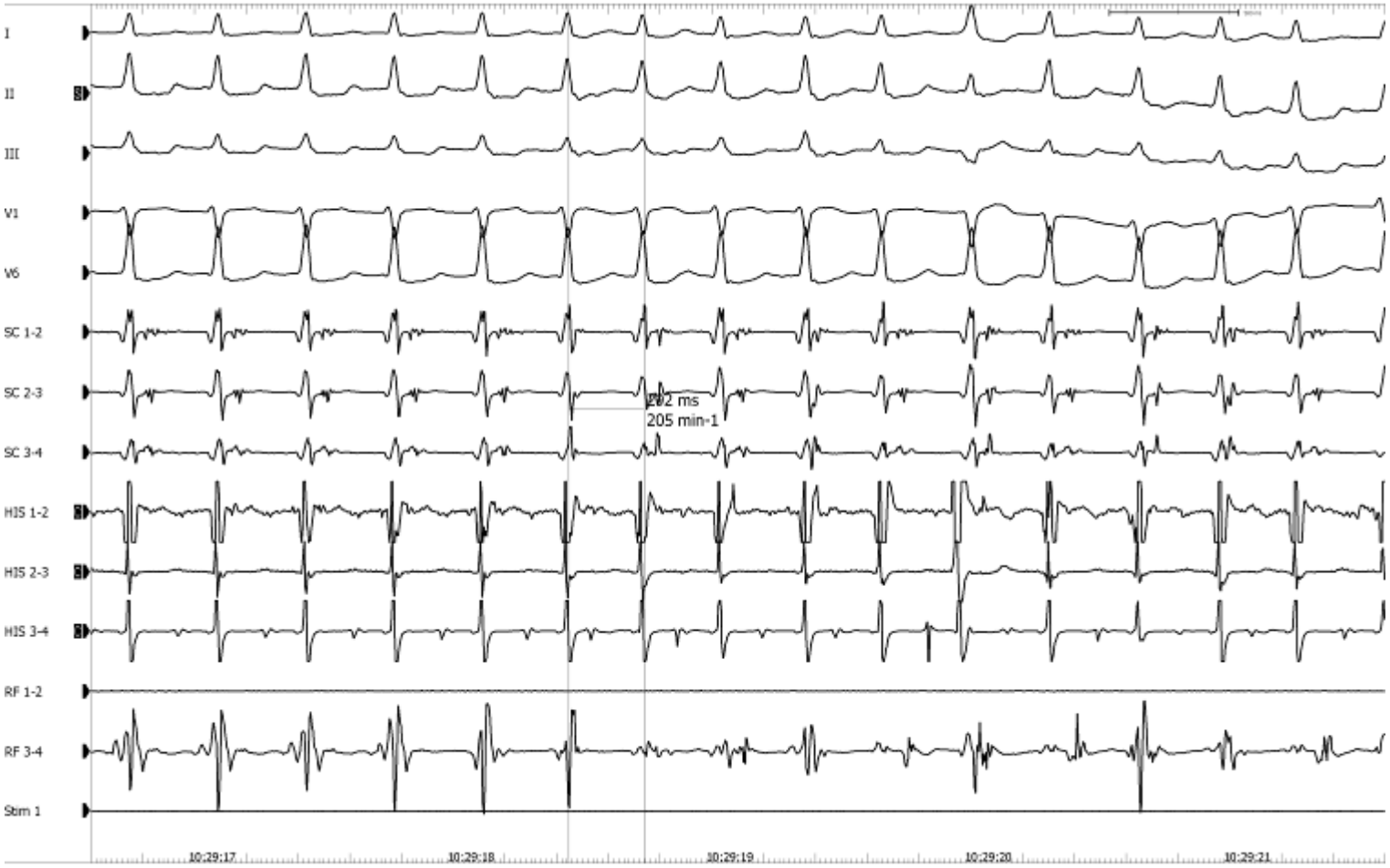
Orthodromic reciprocating tachycardia



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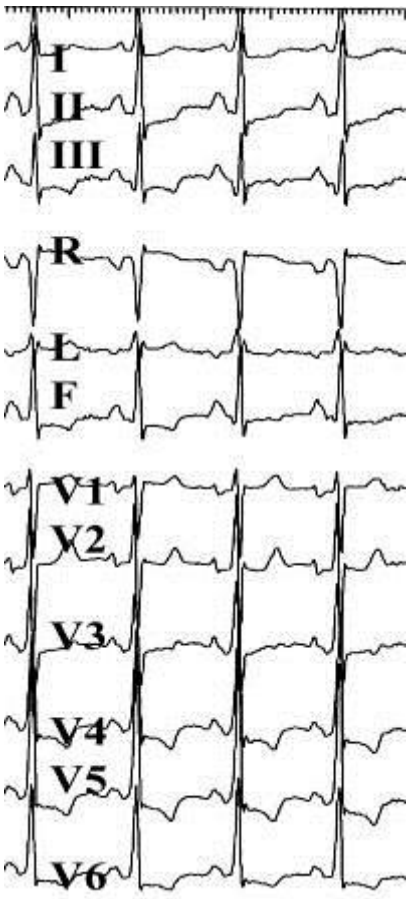
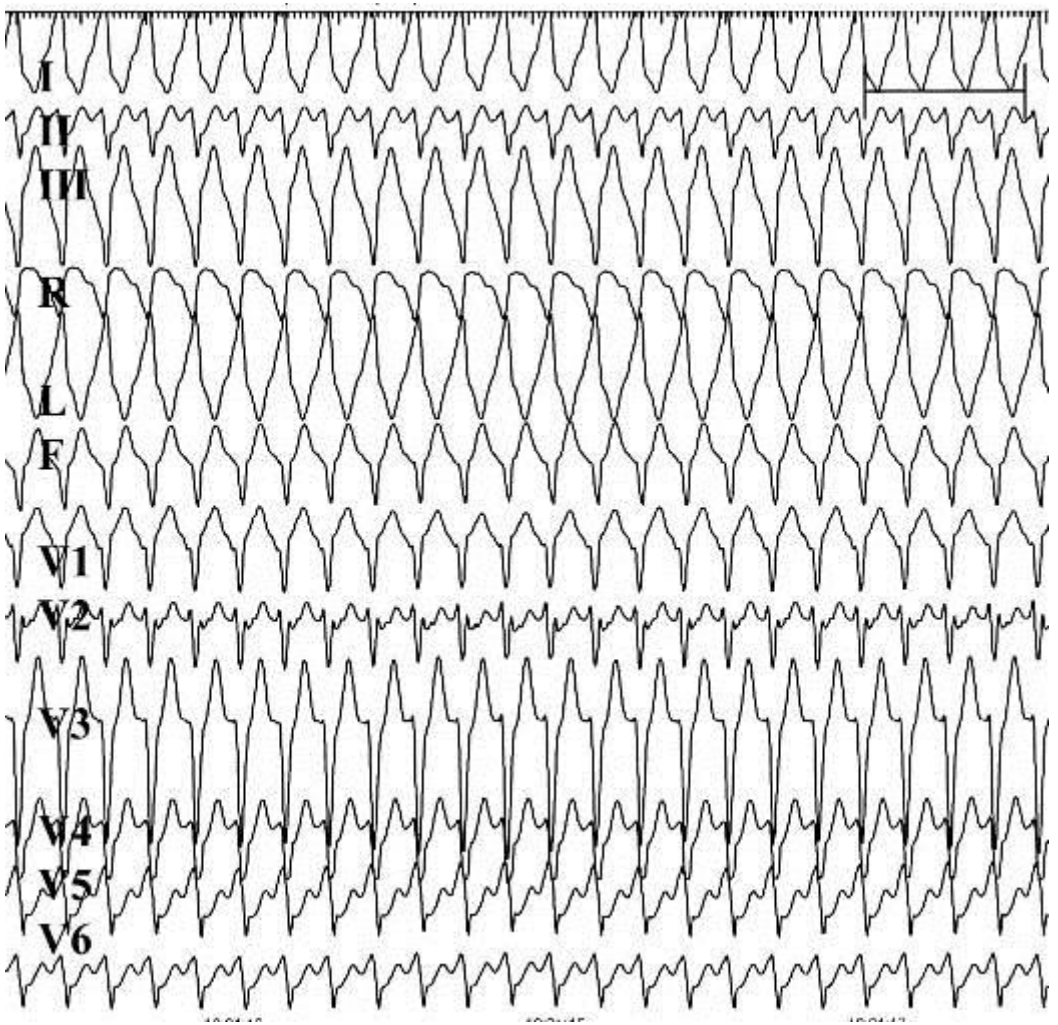
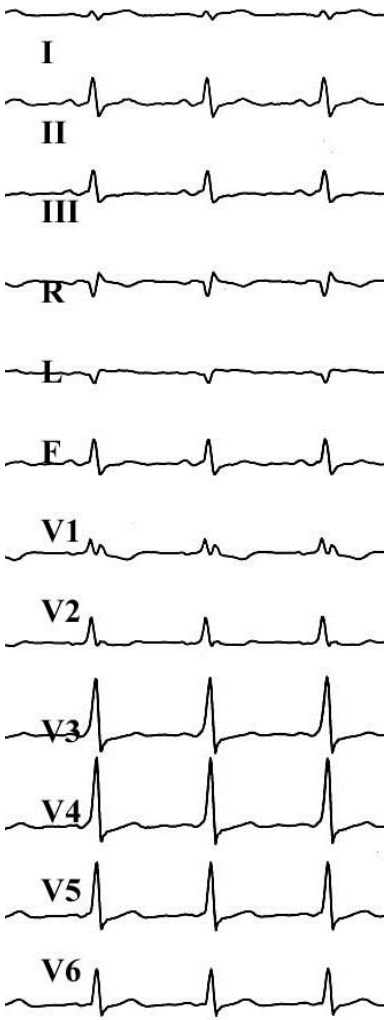
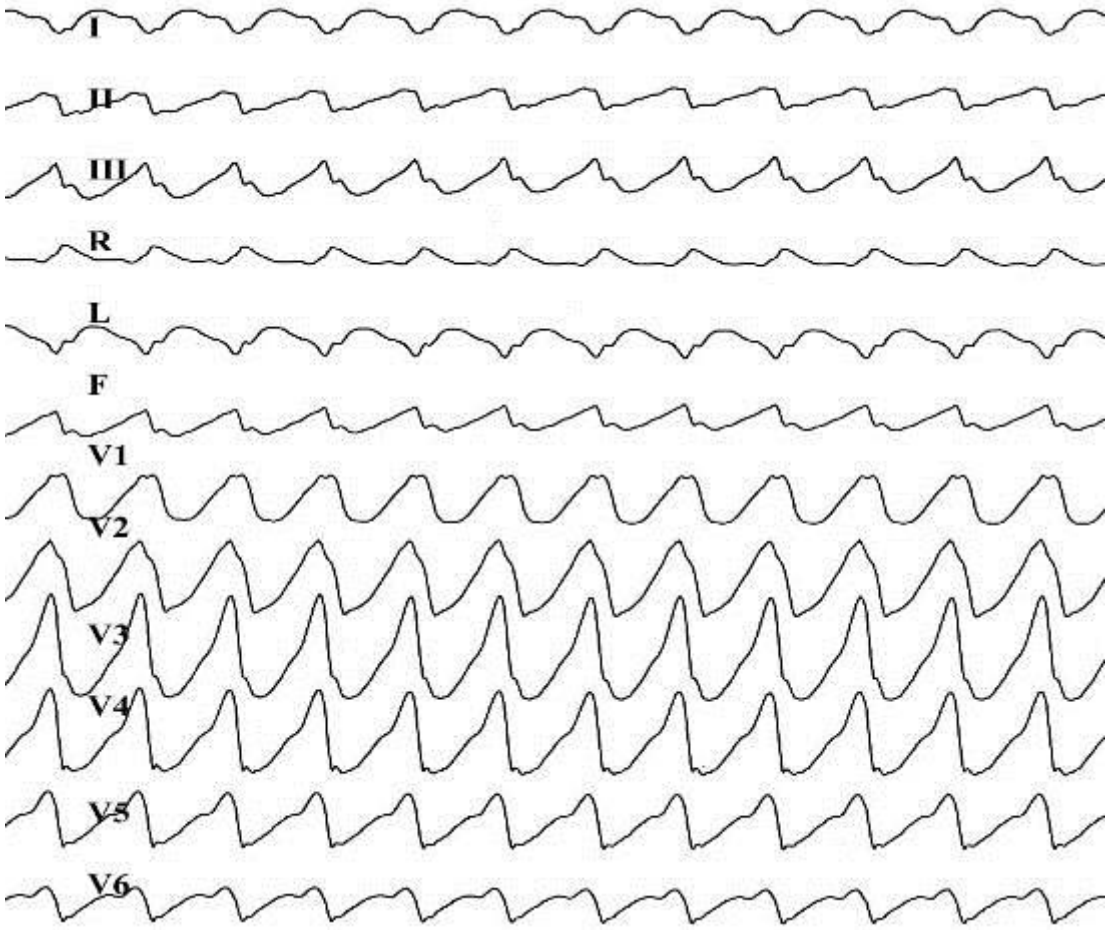
Masked right posteroseptal: antidromic AVRT



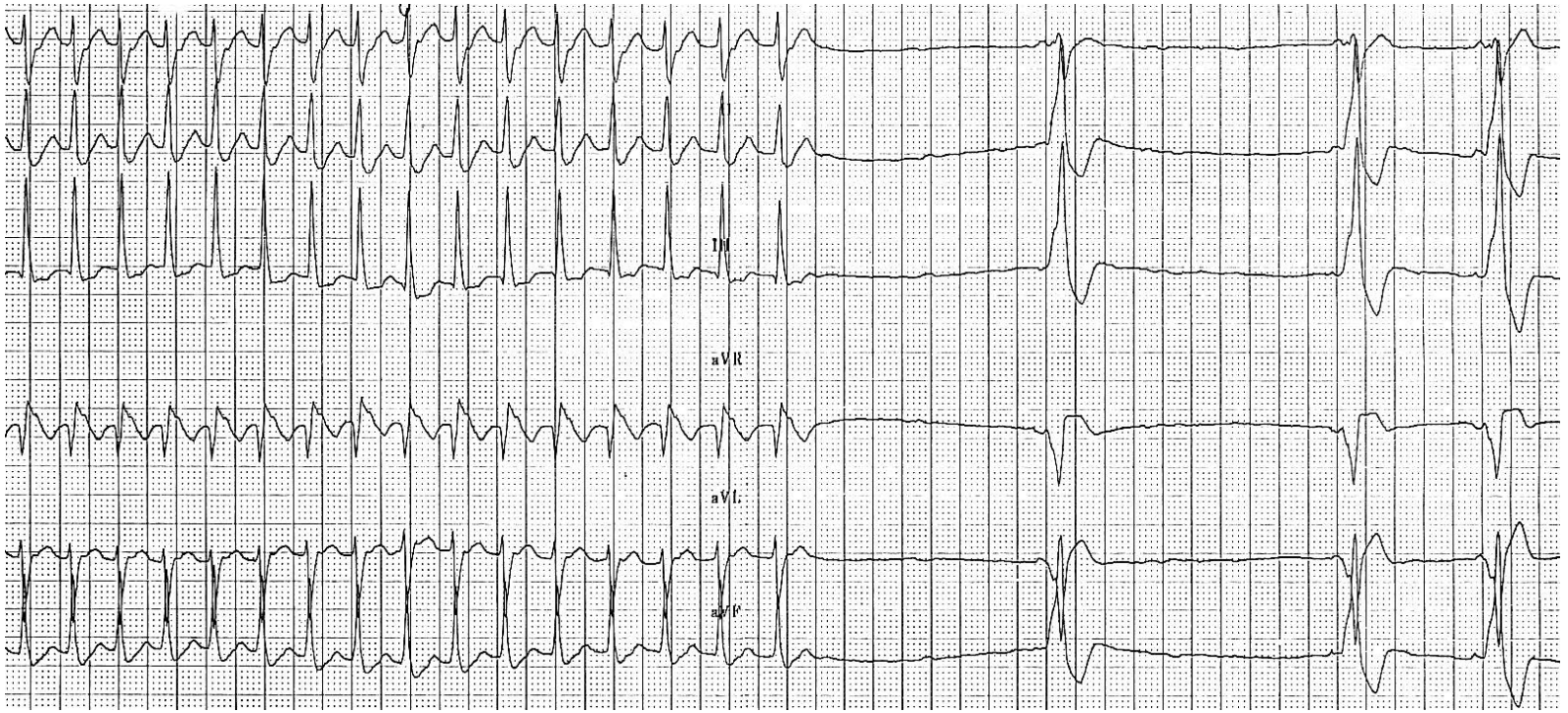


Left lateral: antidromic tachycardia





Adenosine injection



AVRT termination

Preexcited ECG

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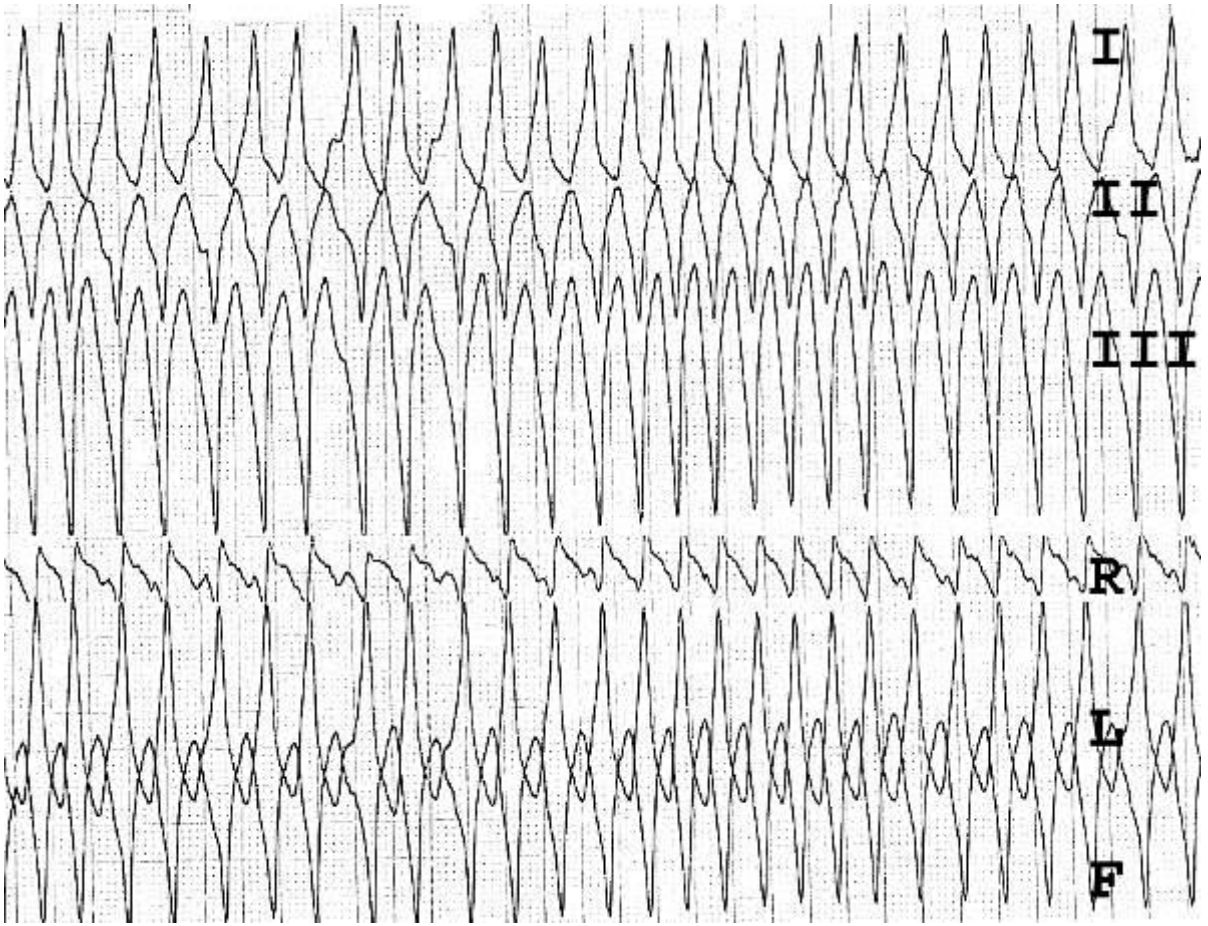
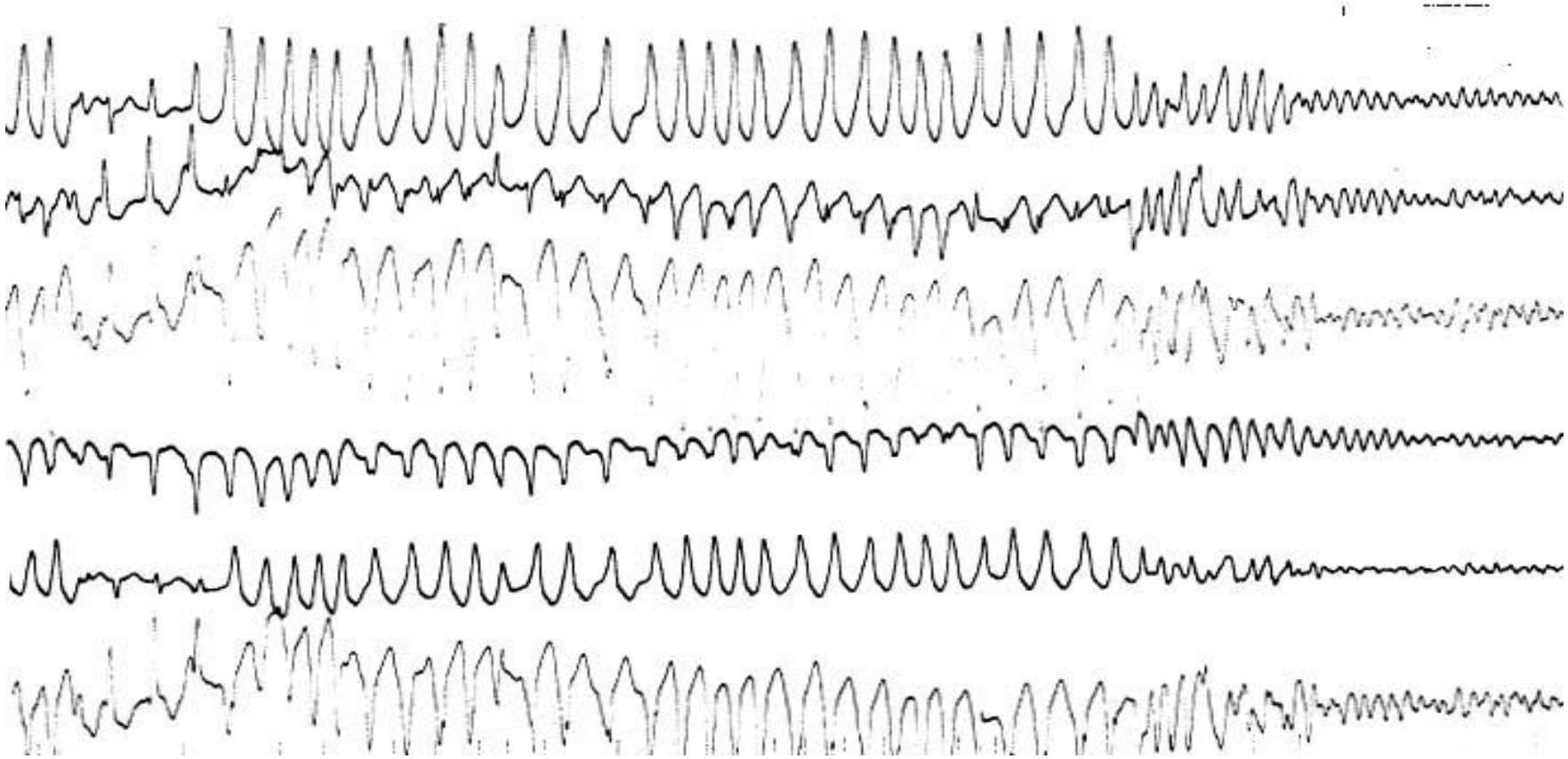
Diagnosis ?

AF conducted by an accessory pathway



AF leading to VF



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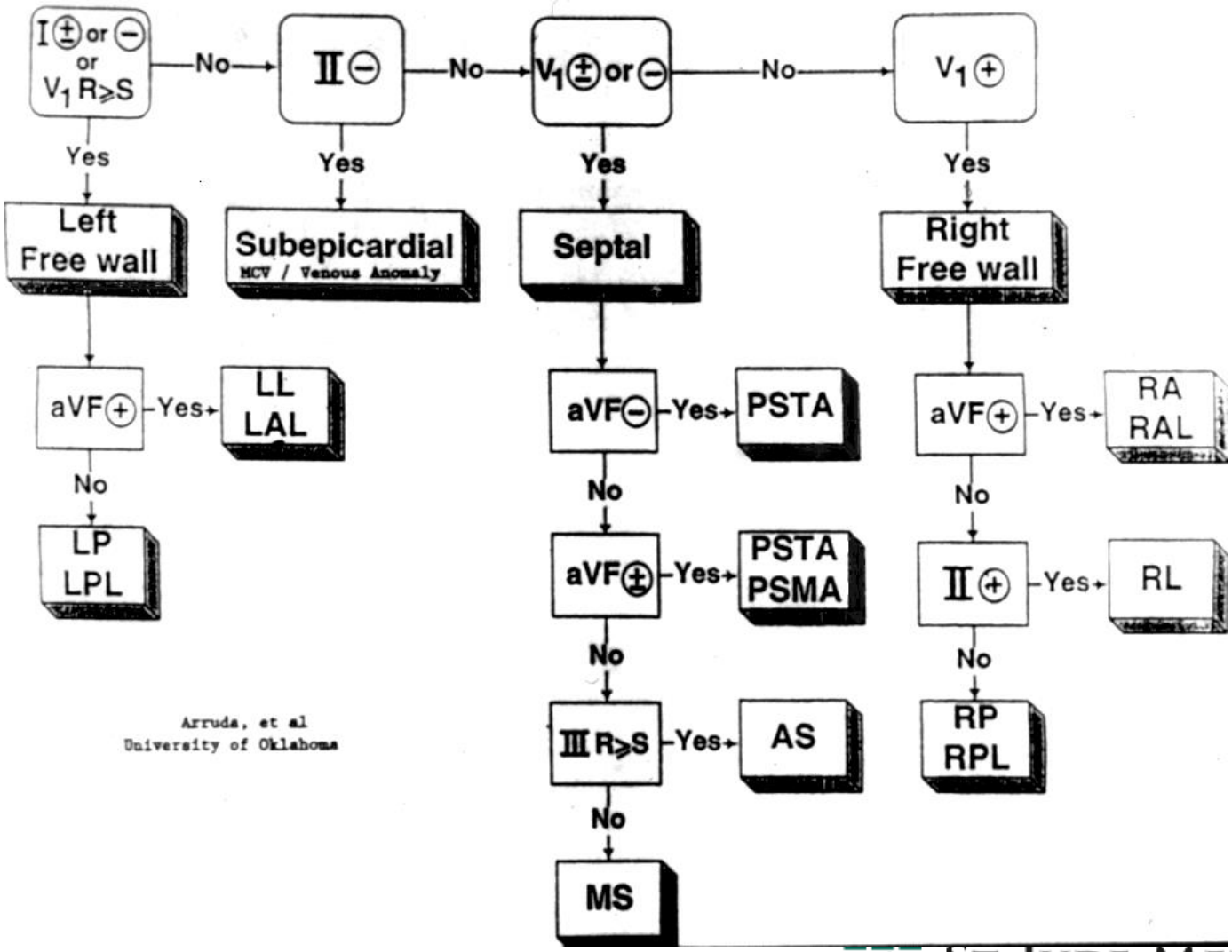
Risk for SCD

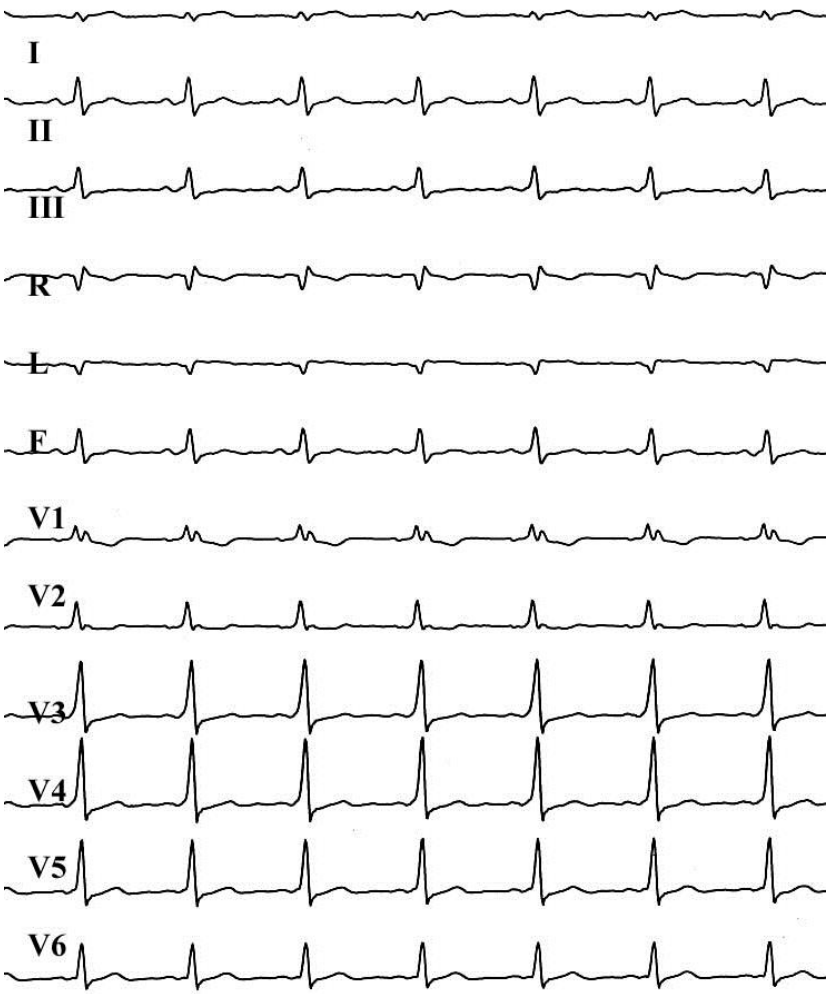
- Short anterograde refractory period
  - < 250 ms
- Arrhythmia induction / atrial vulnerability (+++)
  - Minimum RR interval during AF < 250 ms (sens 92%, spec 46%, PPV 34%, PNV 94%)

	With VF	Without VF
Klein 1979	31 : 140-250	73 : 150-400
1979	31<=250 ms	48/73<=250
1987	7/8<=250	30/58<=250
Torner 1988	8/10<=220	9/31<=220
Attoyan1994	172±23 (28)	230±50 (60)

Location algorithme of WPW



Left lateral



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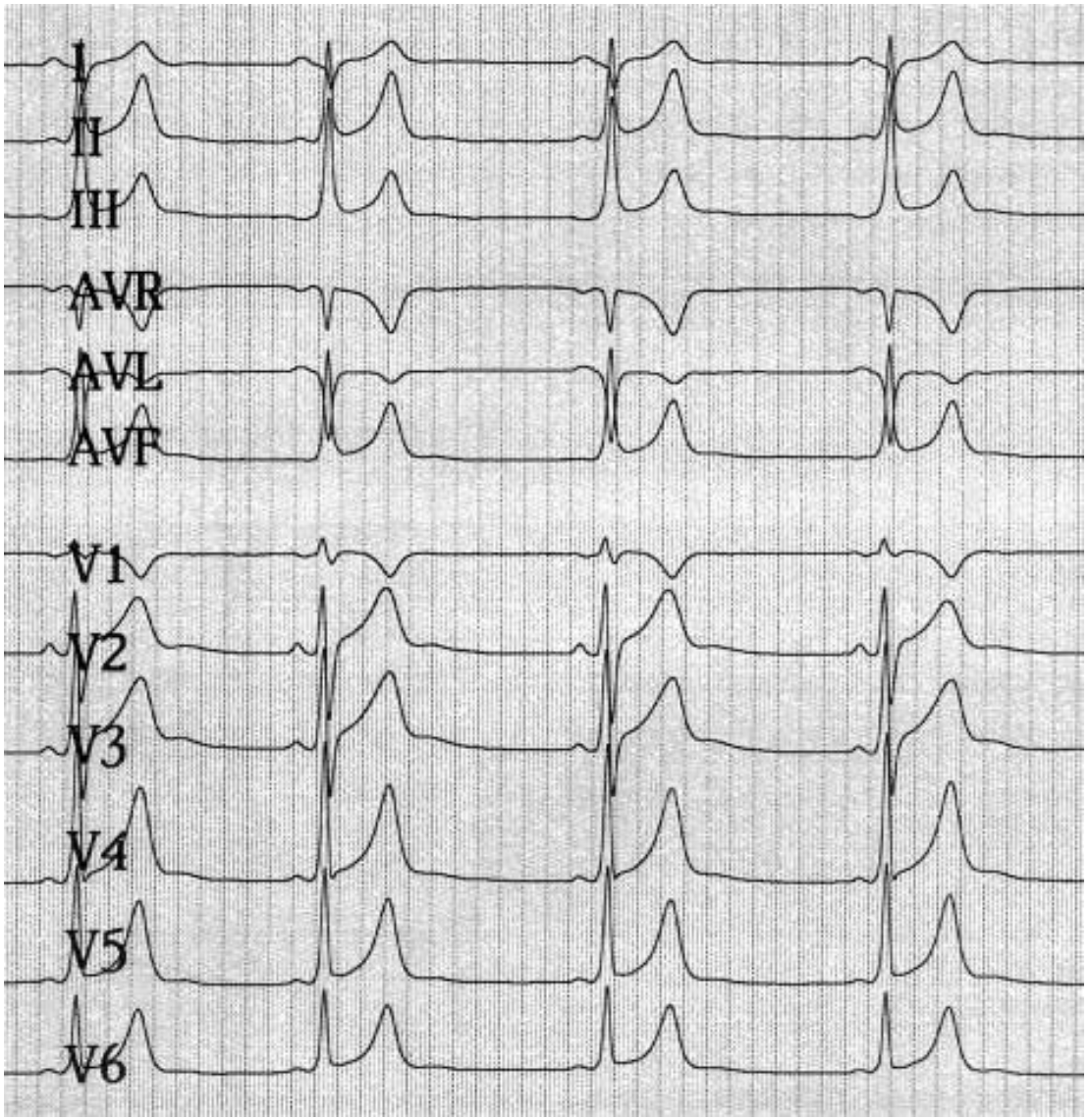
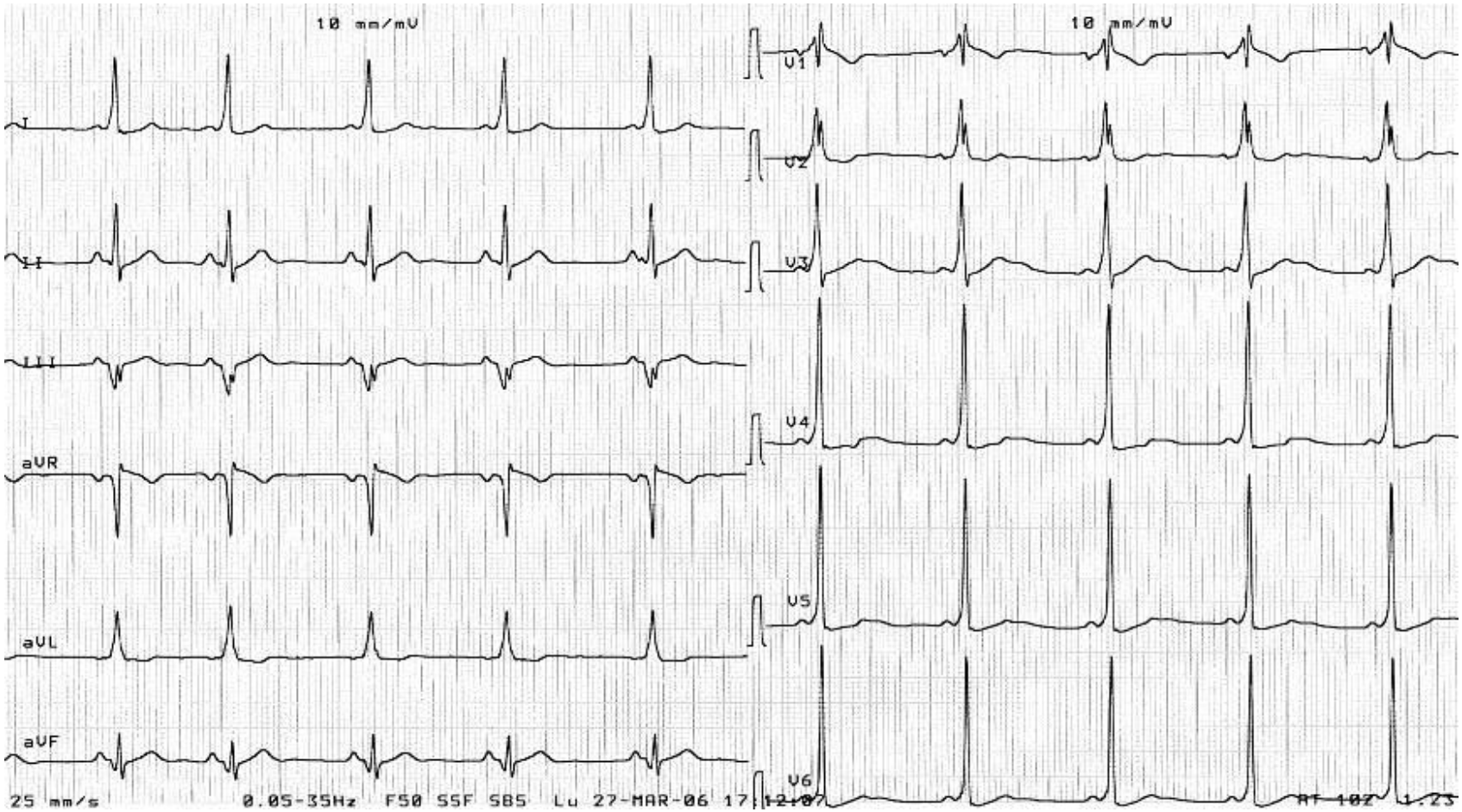
Left lateral



Left posterior



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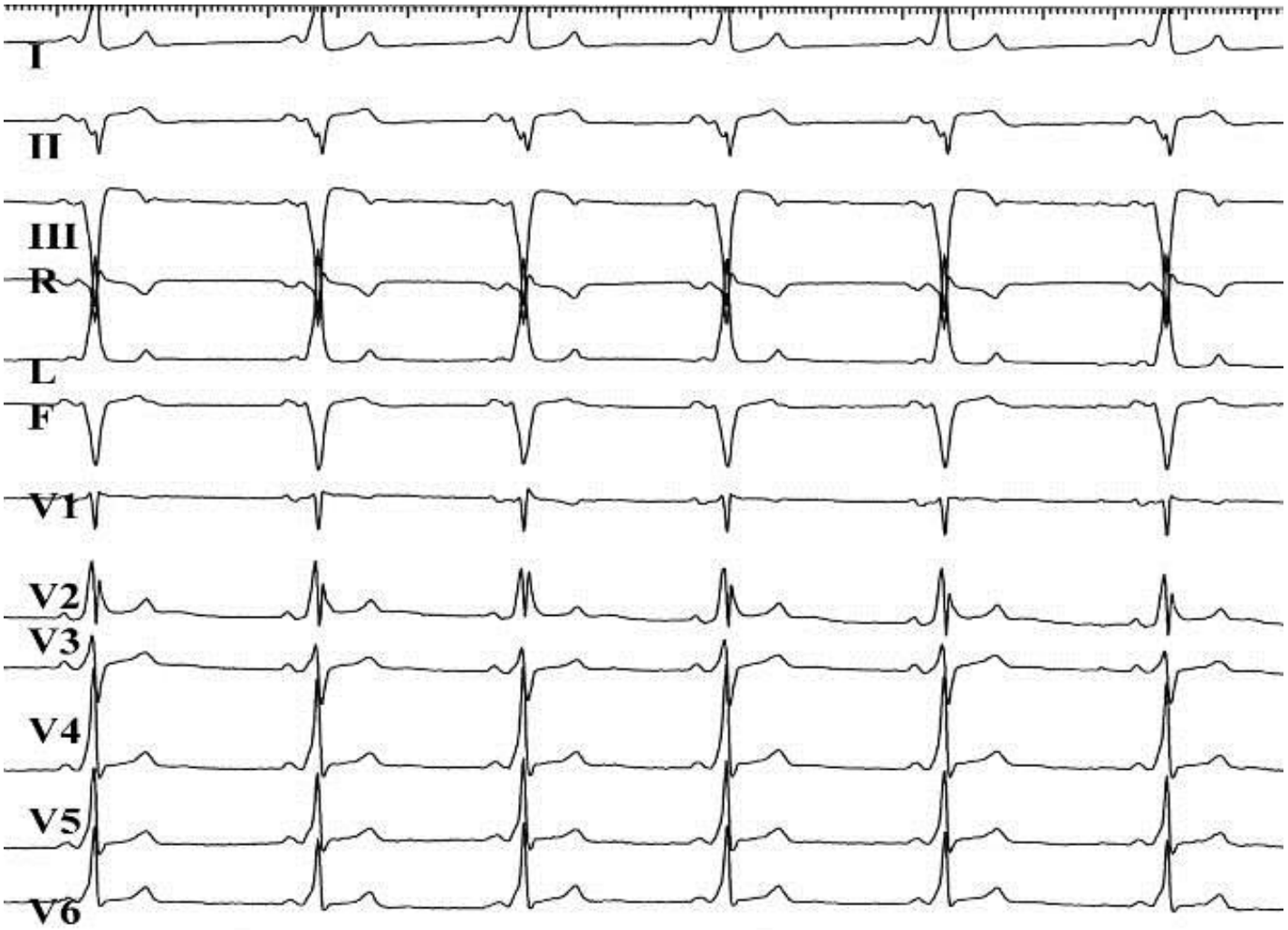
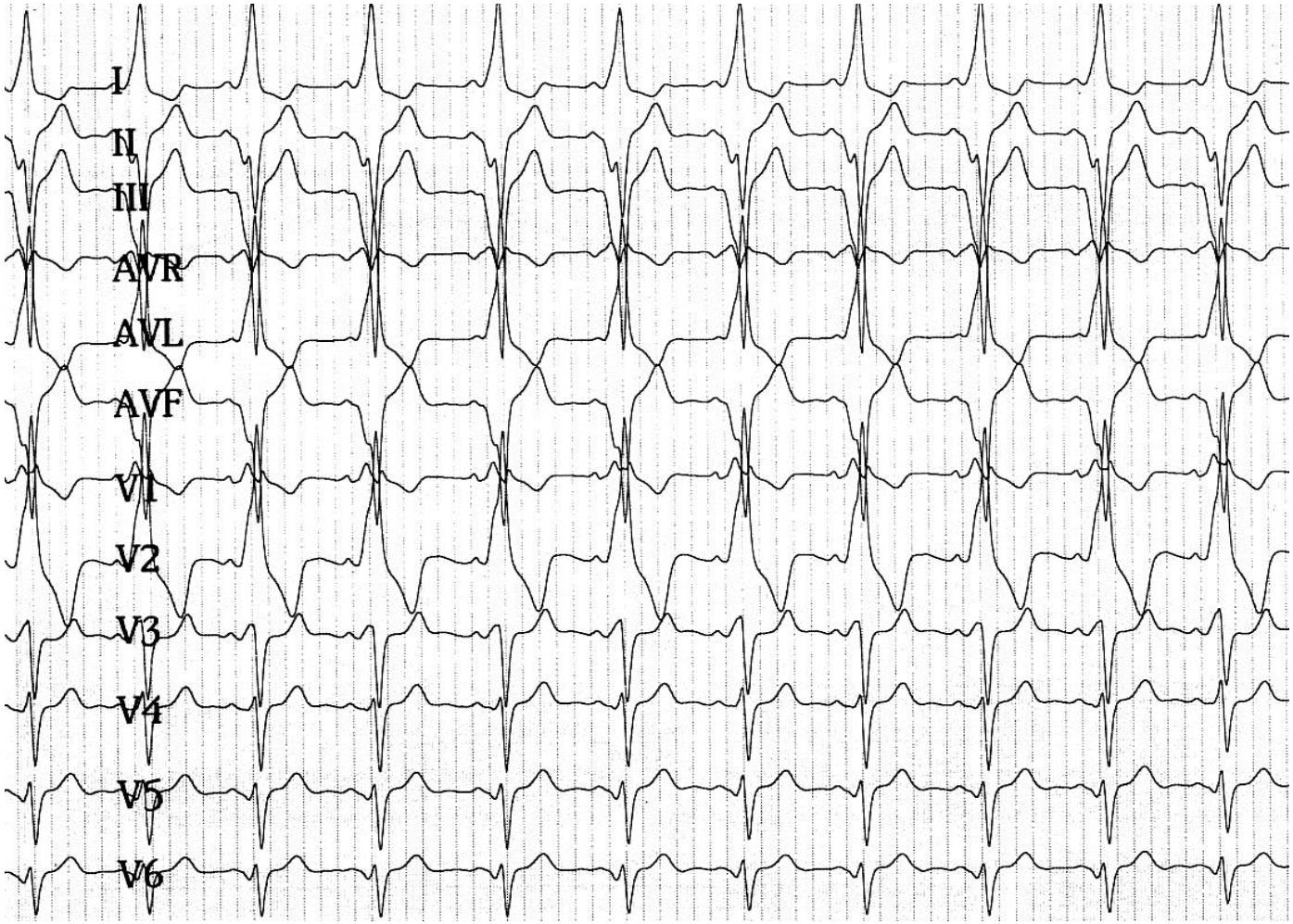
Left posteroseptal



Epicardial: MCV



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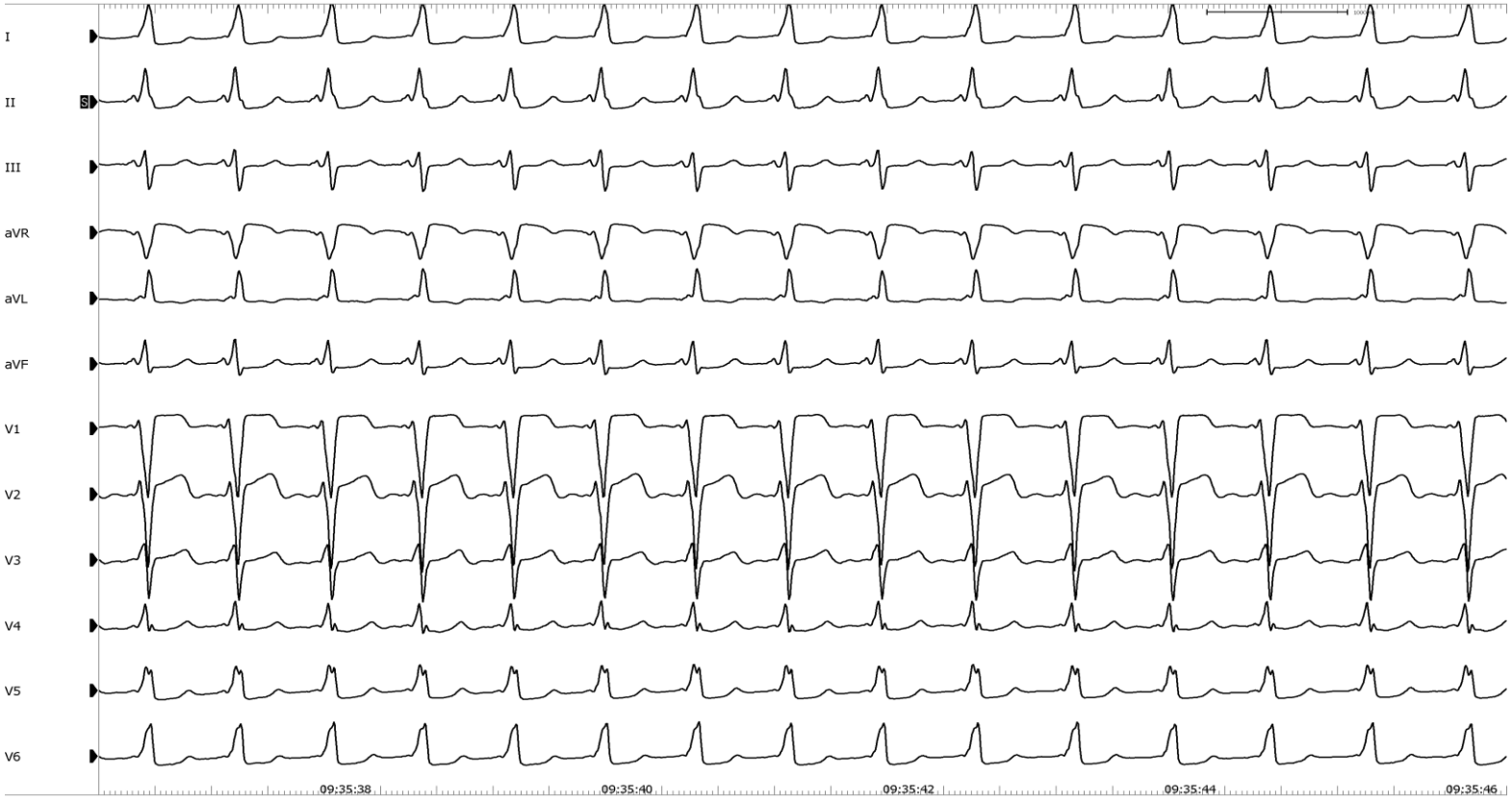
Anteroseptal (para-Hisian)



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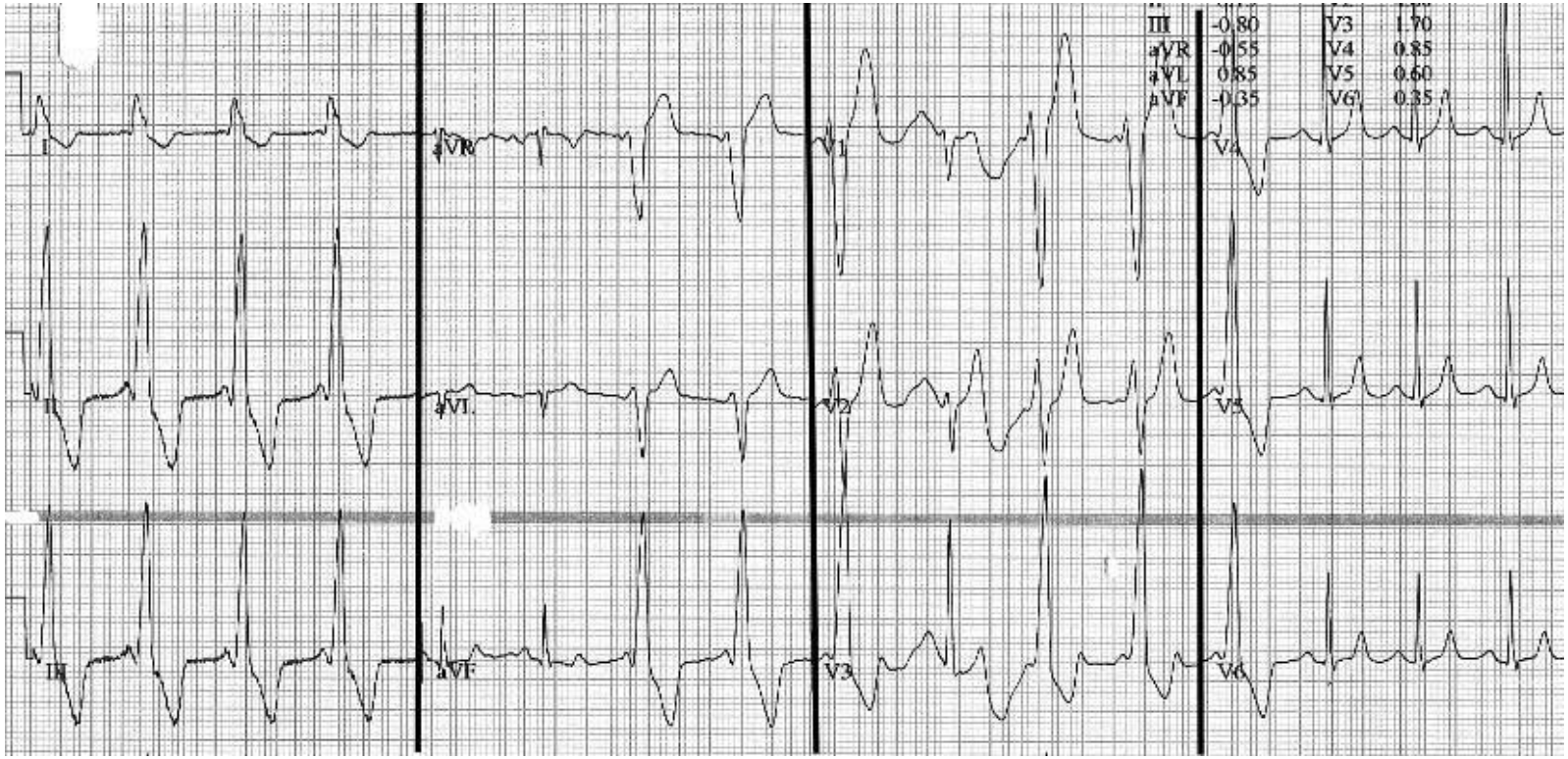
Intermittent para-Hisian



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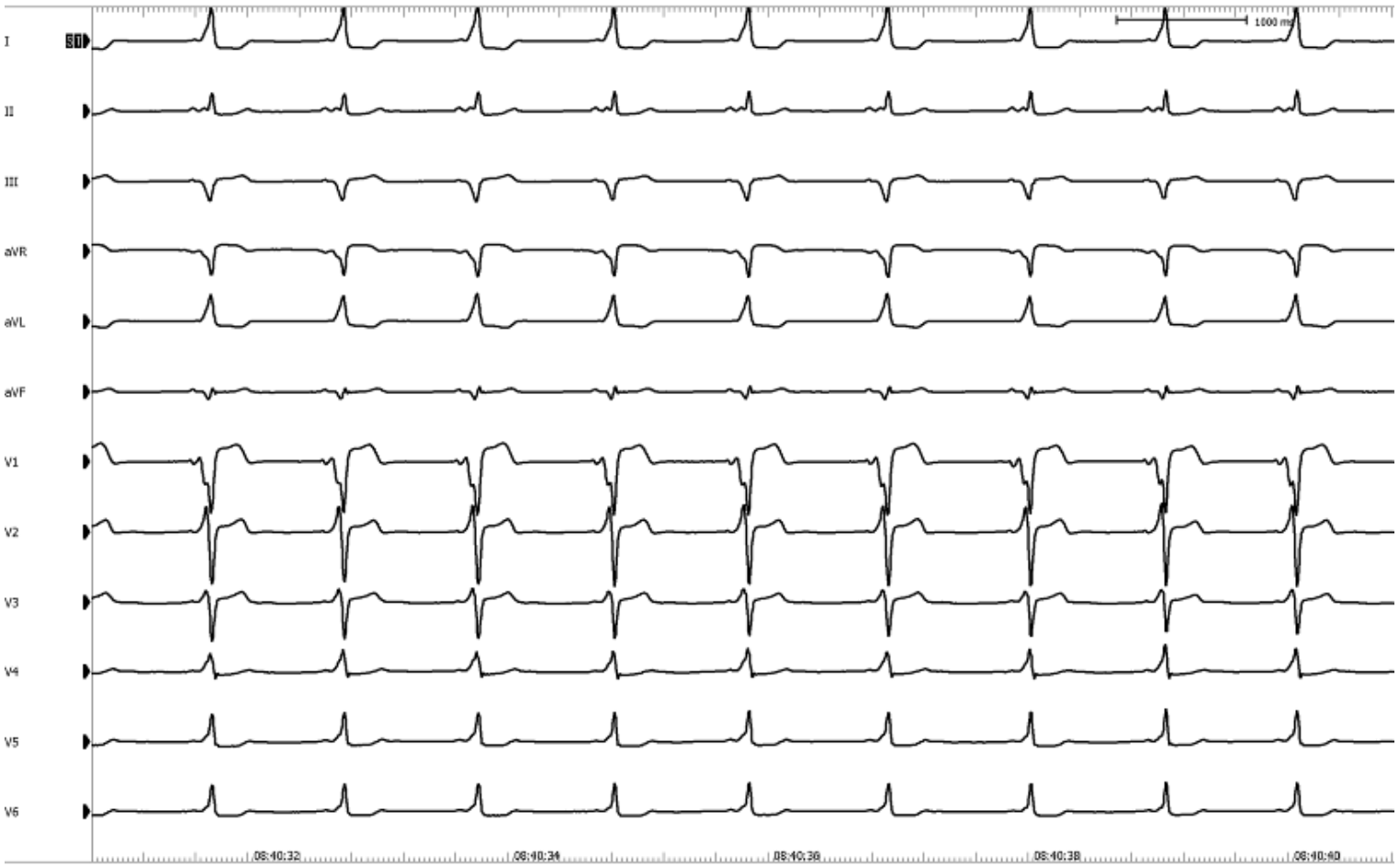
Right lateral



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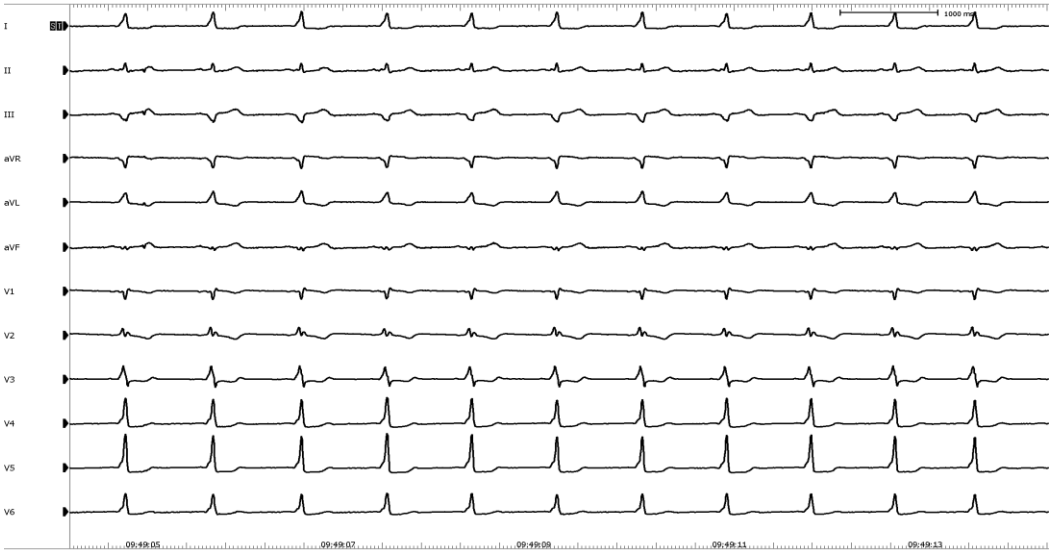
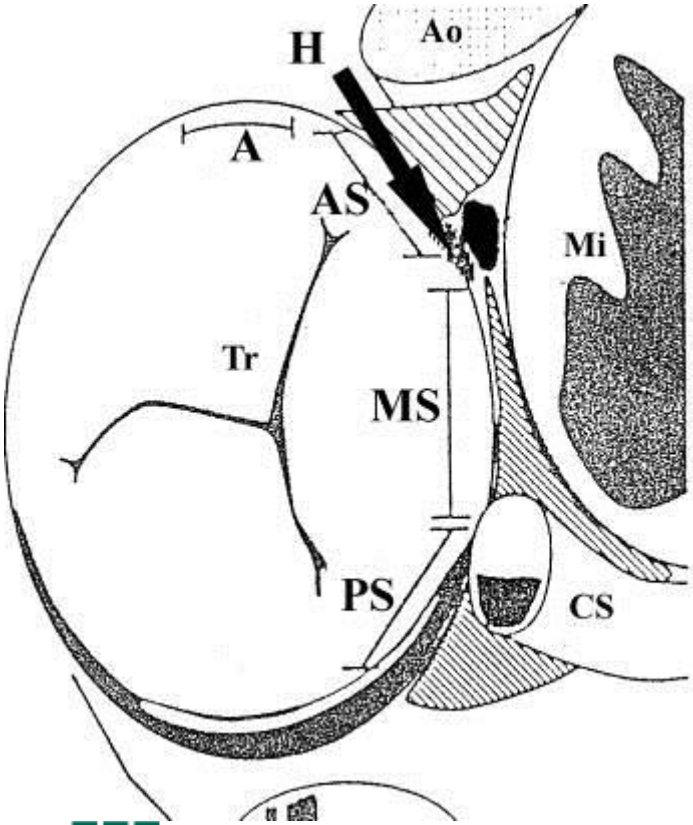
Right midseptal accessory pathway





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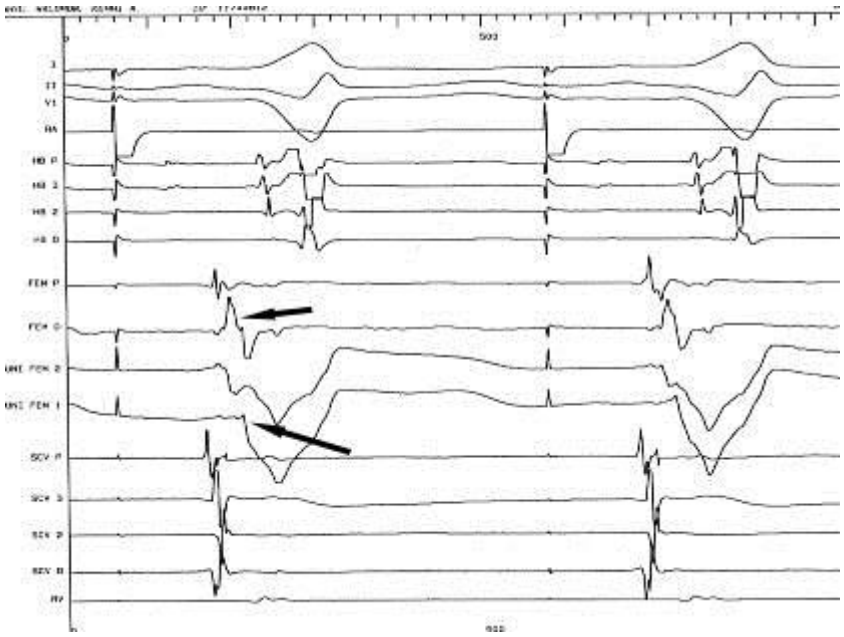
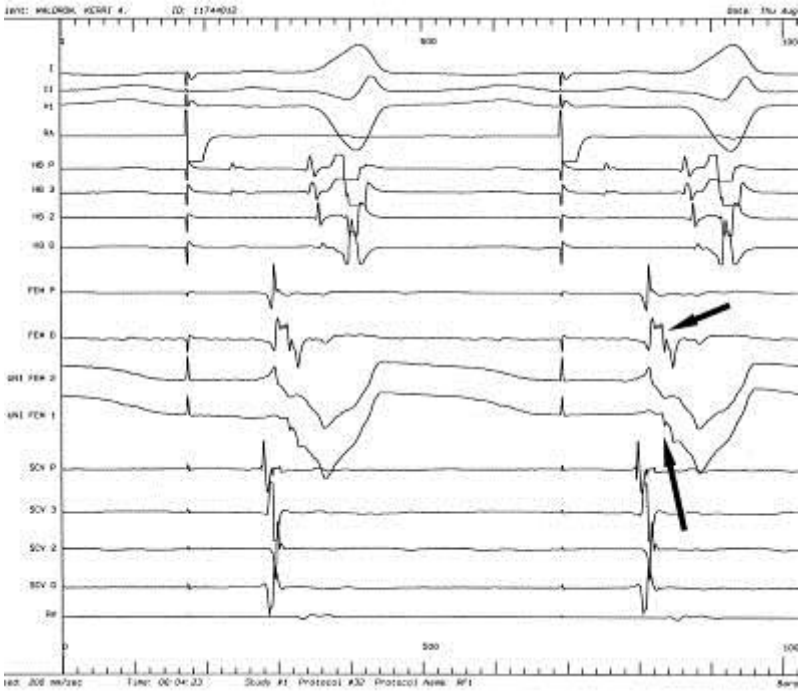
Mapping

- Manifest AP
  - Anterograde mapping
    - Sinus rhythm / atrial pacing (super-Wolff)
  - Retrograde confirmation
    - Oblique pathways
- Concealed pathway
  - During orthodromic reciprocating tachycardia
  - Retrograde conduction / ventricular pacing

Right posteroseptal mapping





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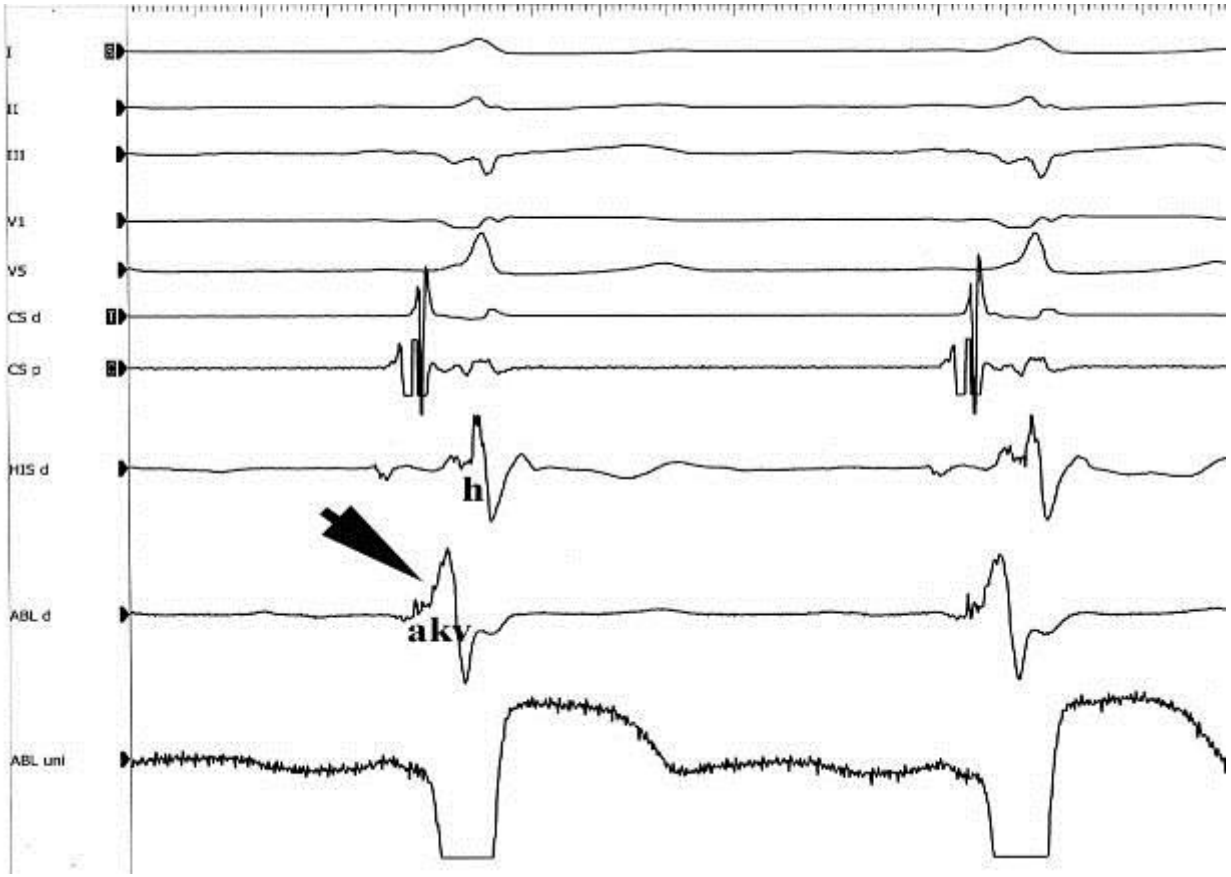
Right midseptal mapping



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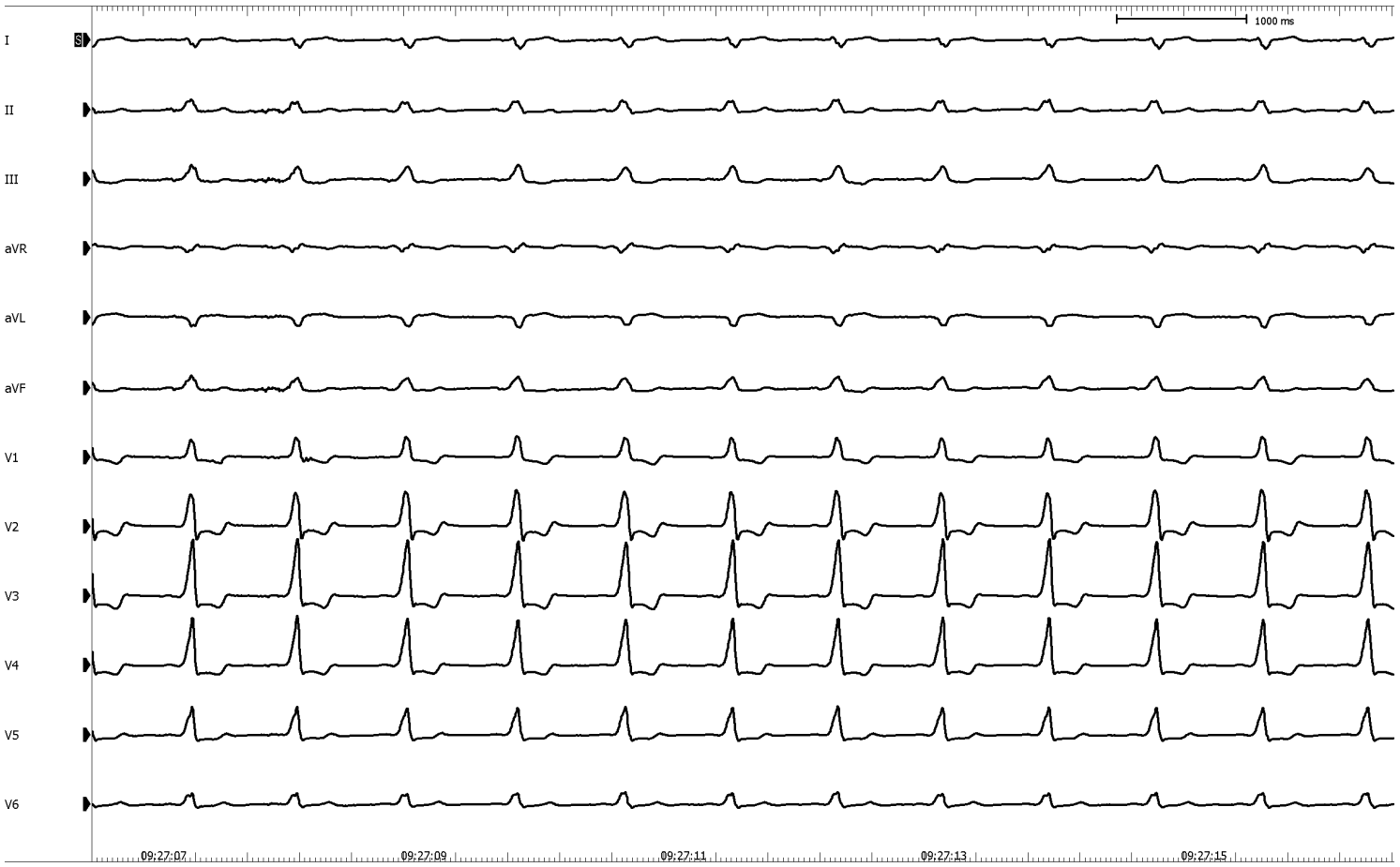
Left lateral pathway



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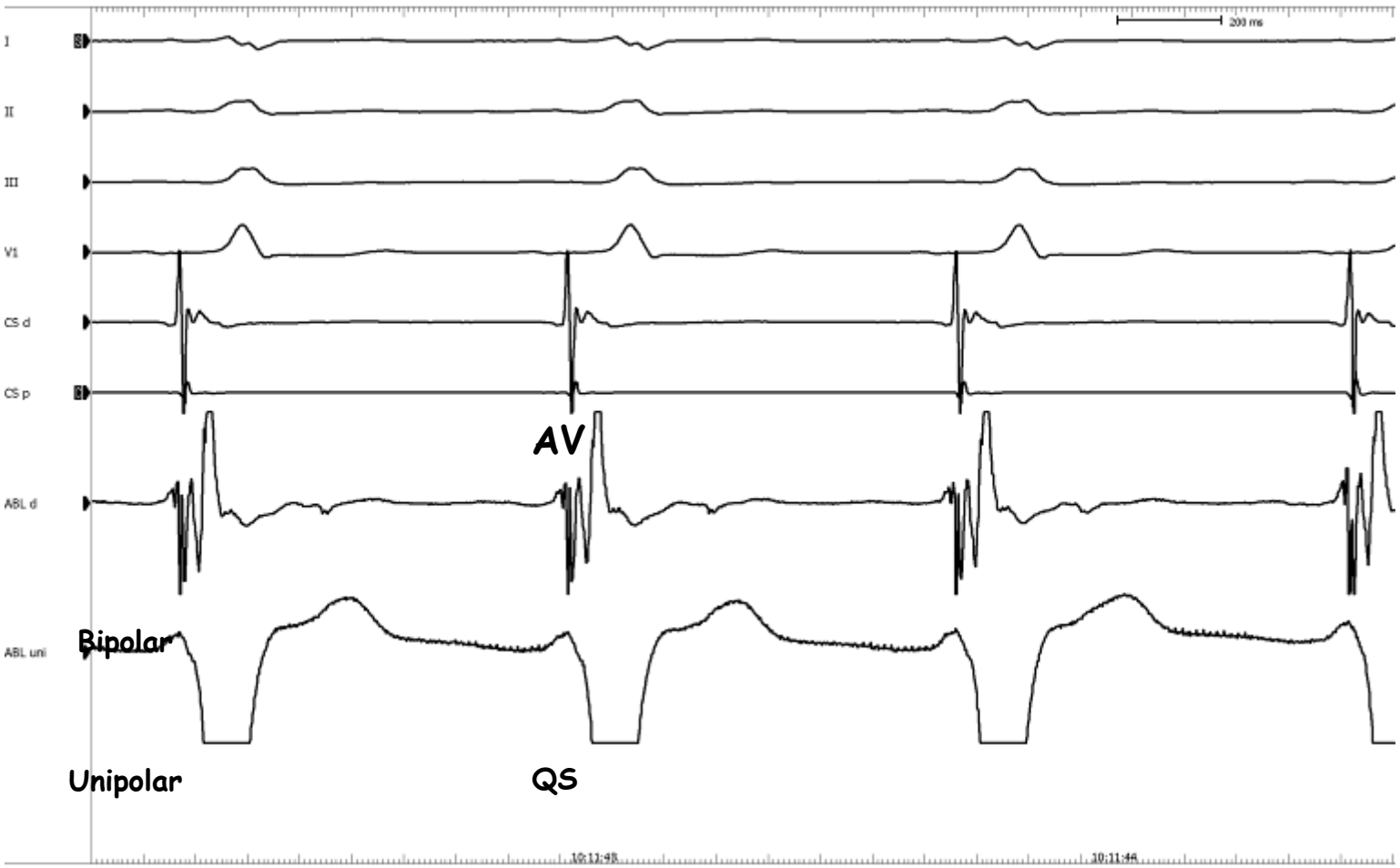
Bipolar and unipolar recording



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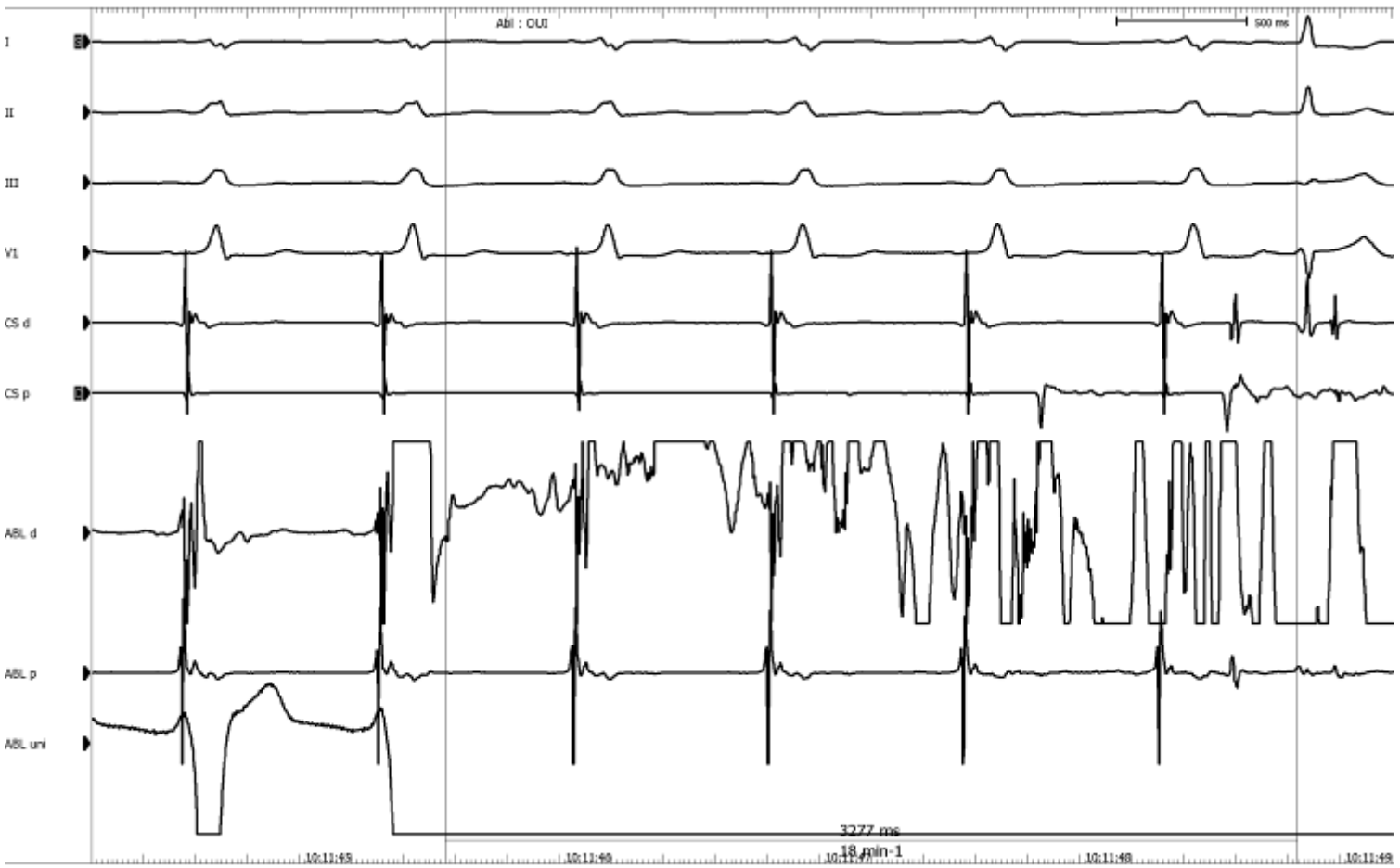
RF delivery



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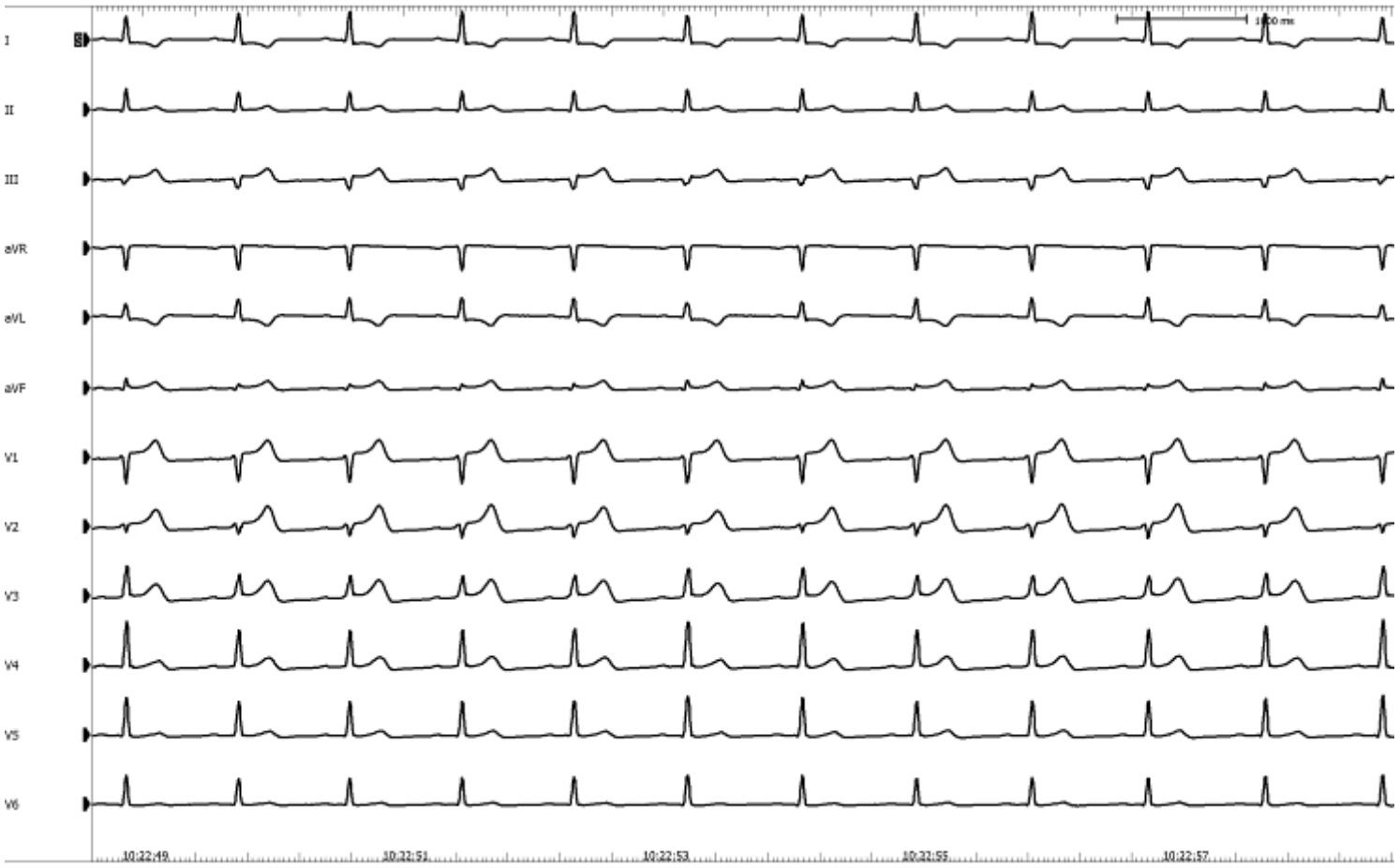
Post ablation ECG



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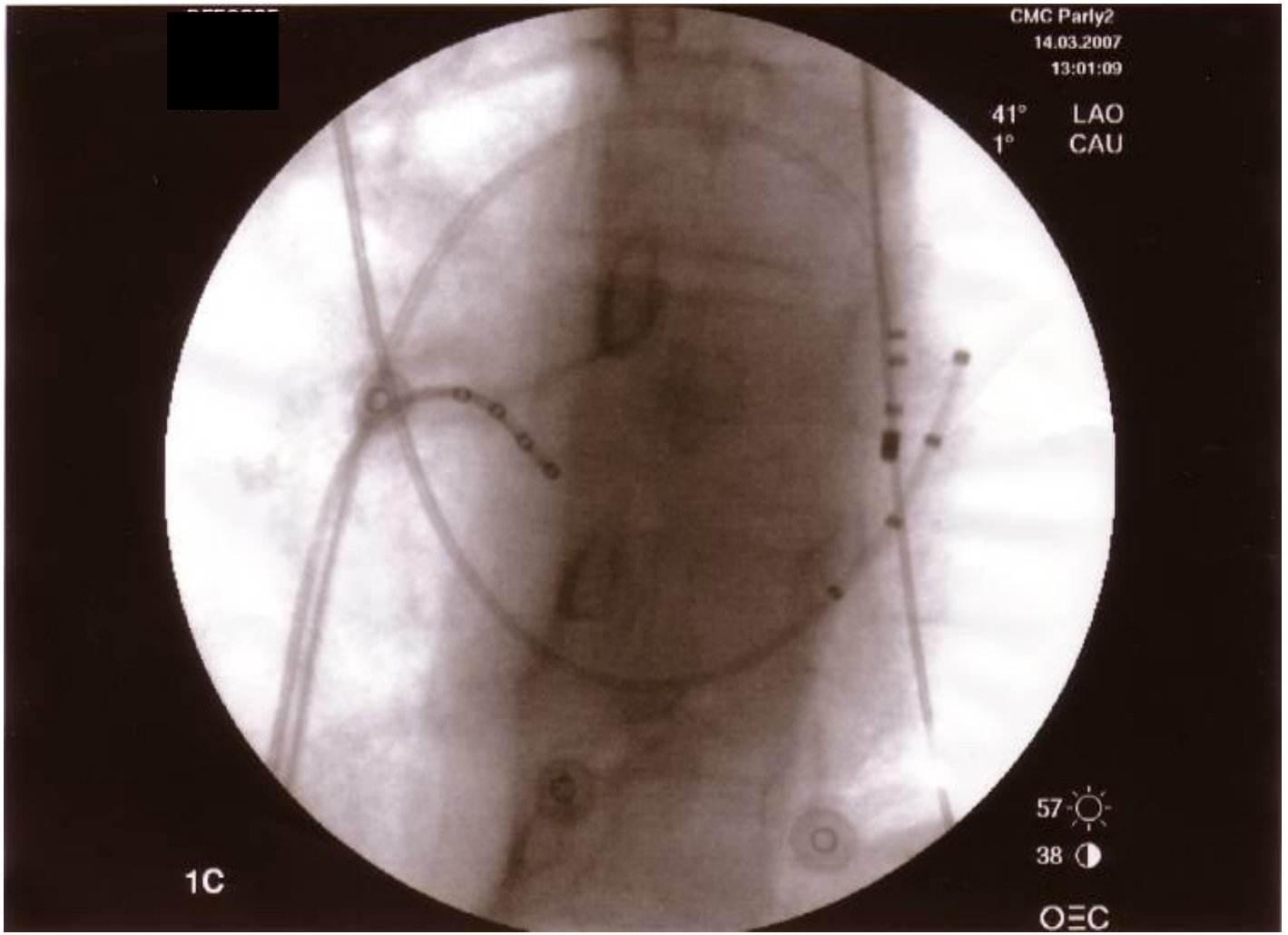
Trans-septal approach



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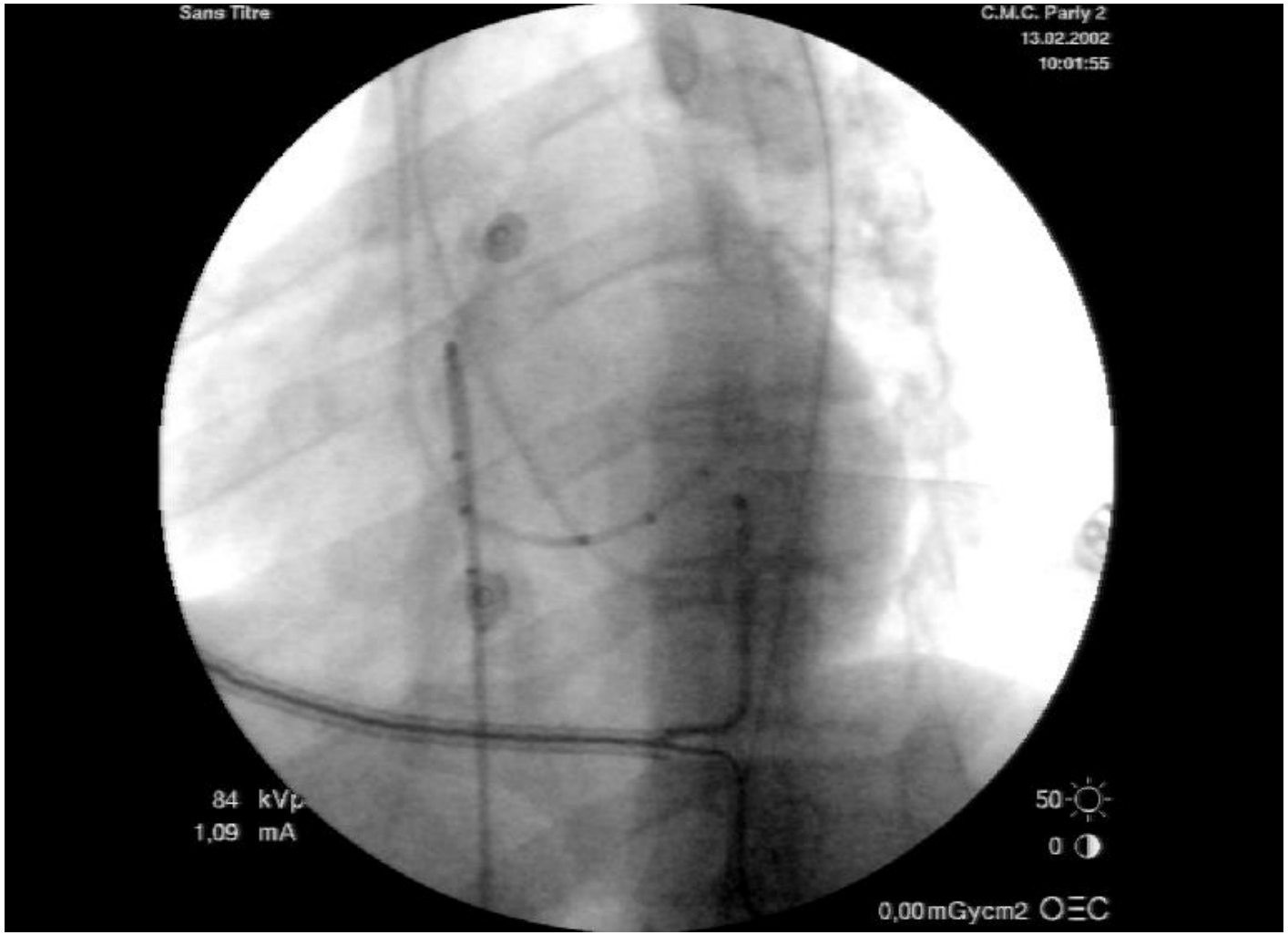
Retrograde approach



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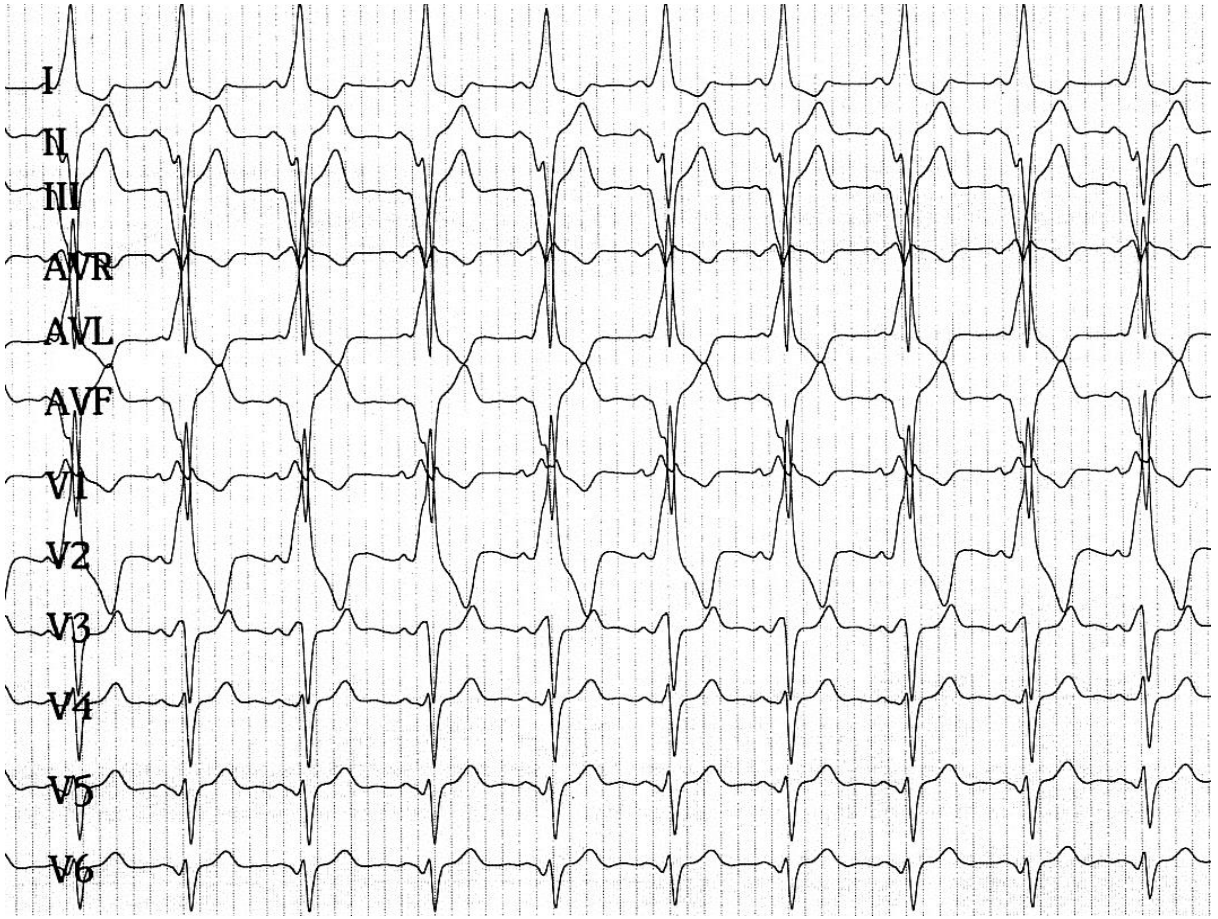
Epicardial pathway: MCV



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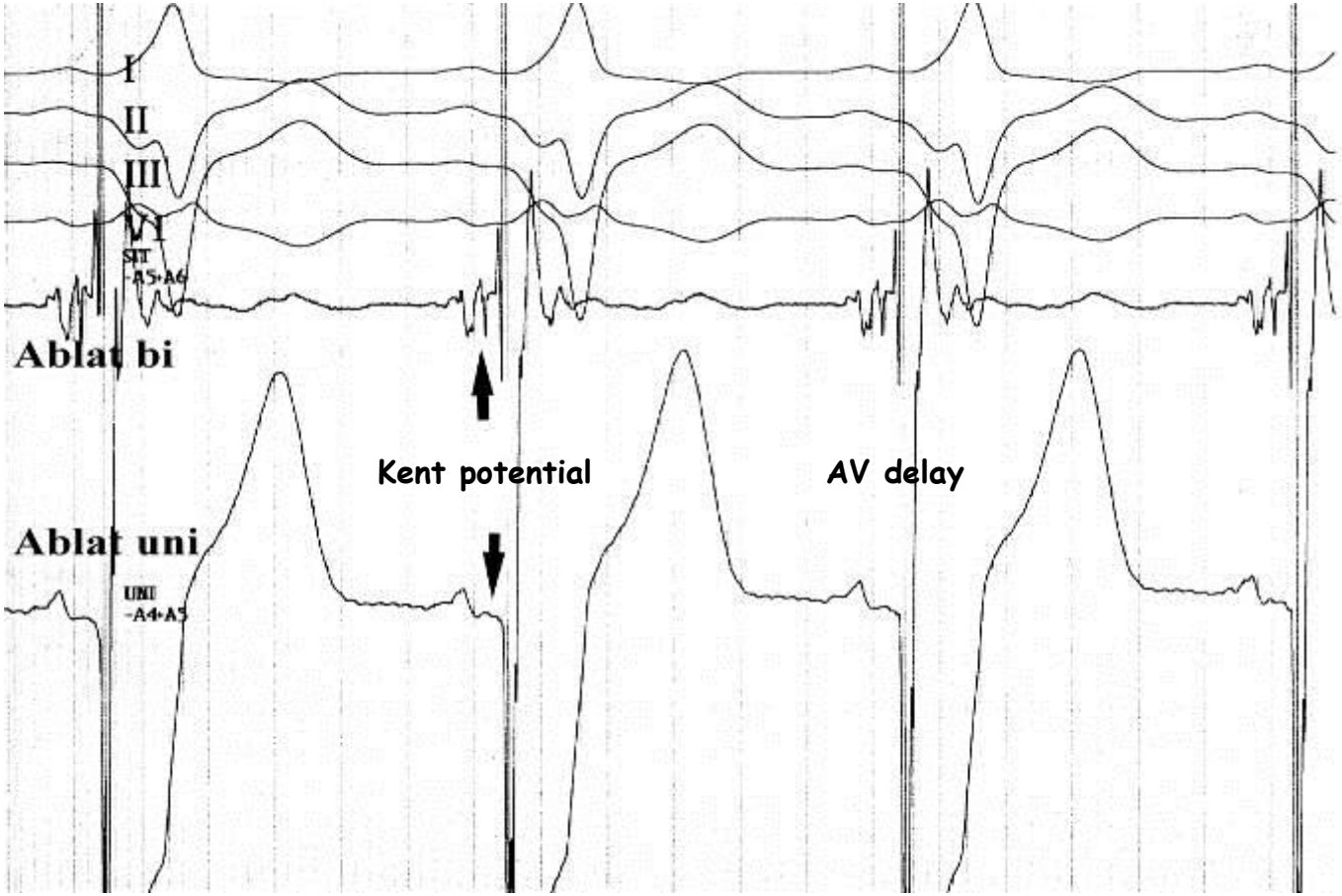
Successful ablation site



Jackman et al.

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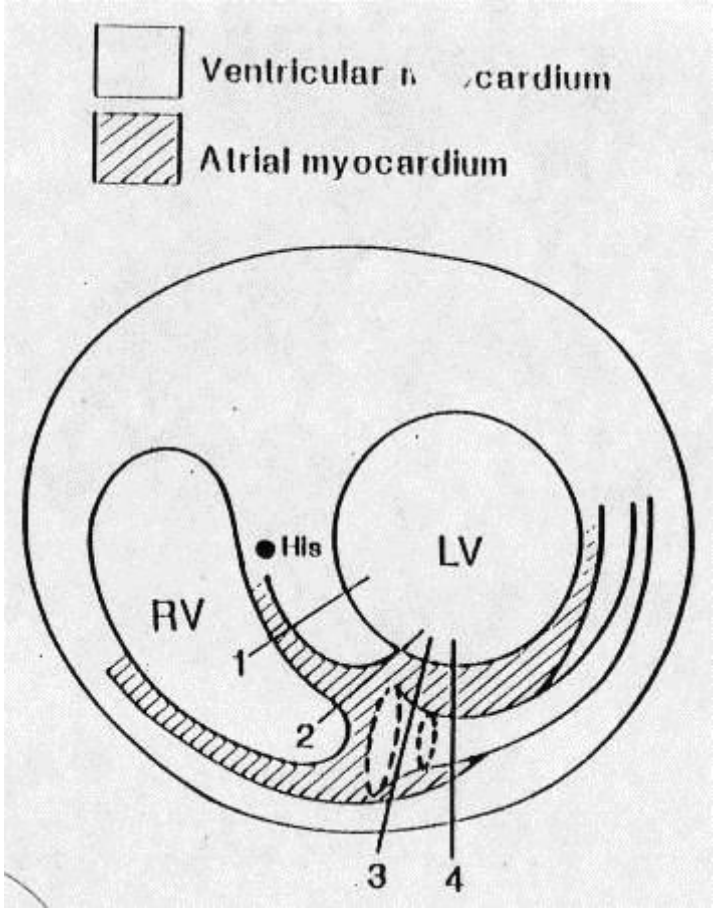
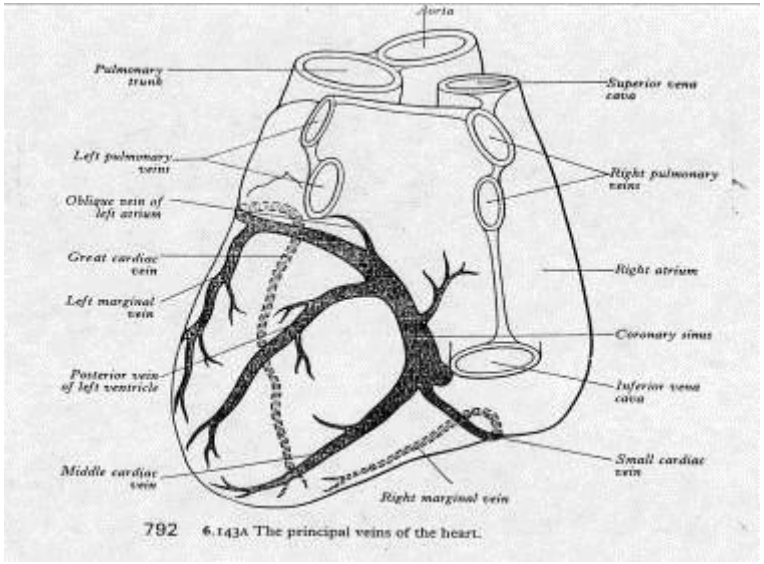
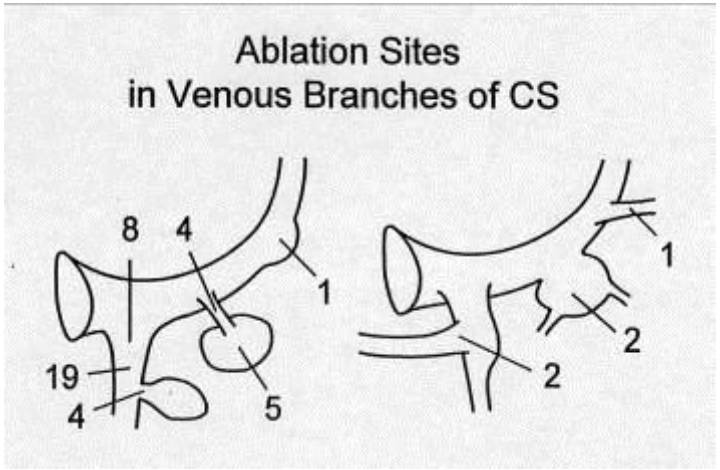
Posteroseptal region







Jackman et al.

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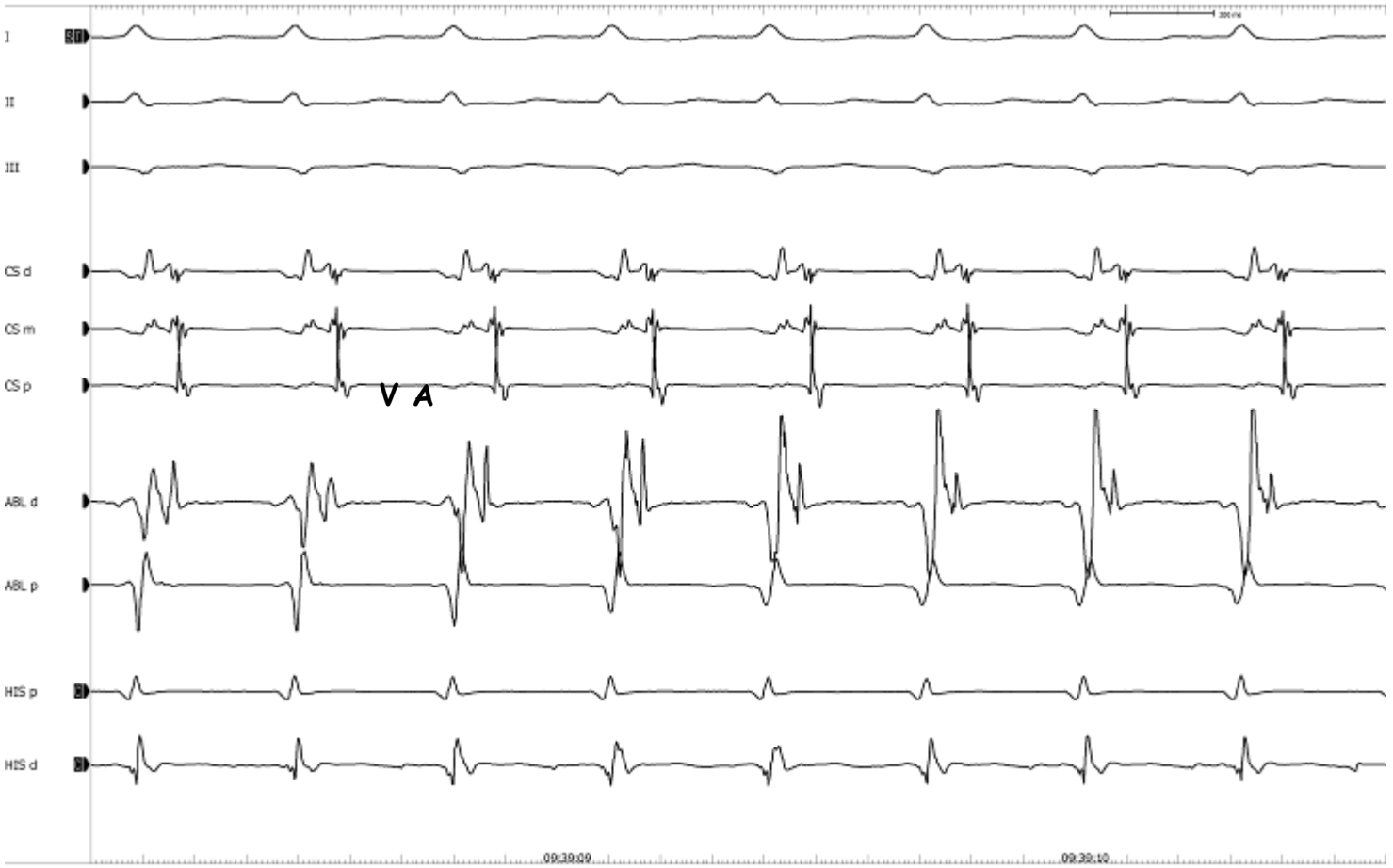
Concealed left lateral: mapping during tachycardia



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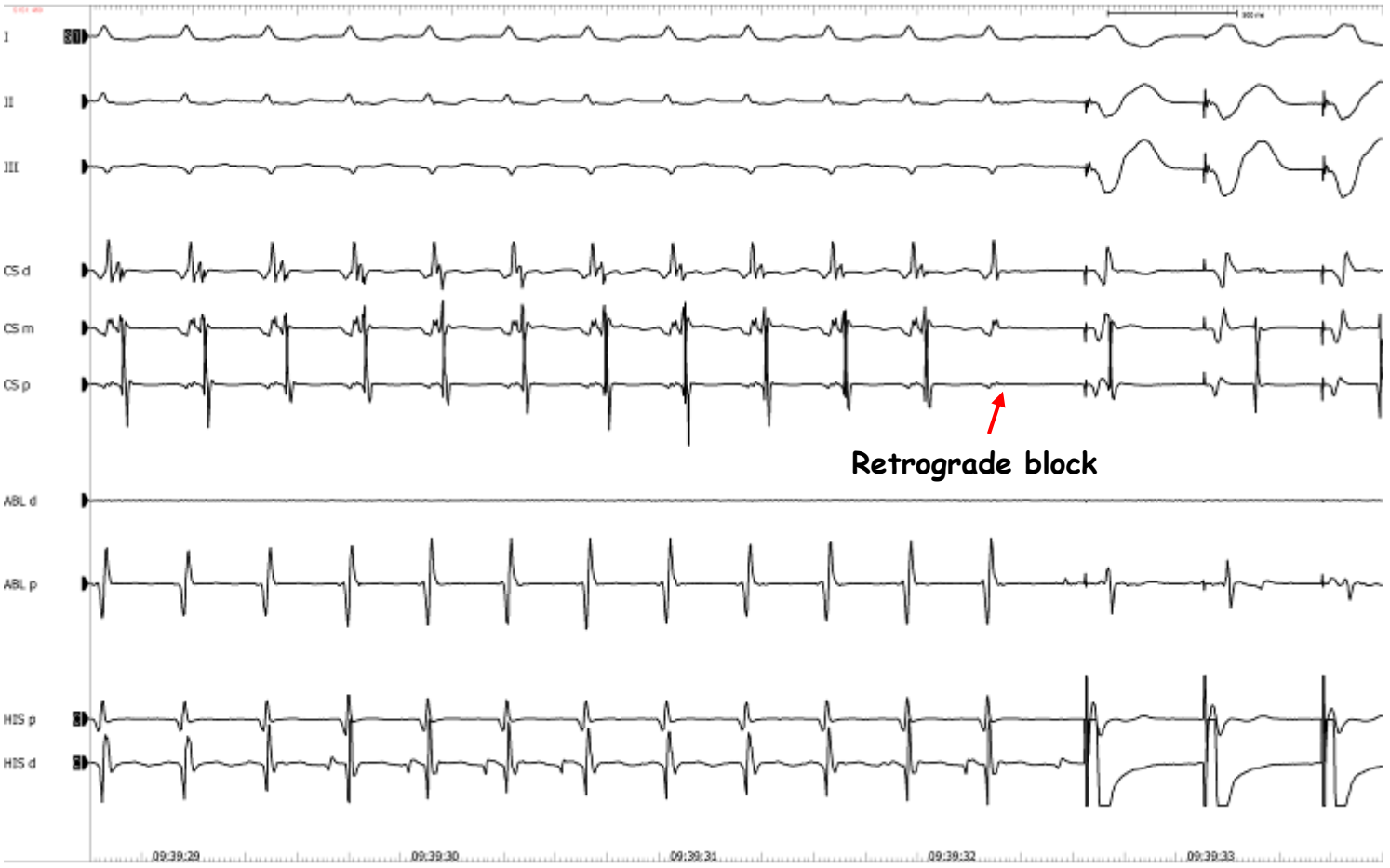
Success: VA dissociation during ablation



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Reversing the Direction of Paced Ventricular and Atrial Wavefronts Reveals an Oblique Course in Accessory AV Pathways and Improves Localization for Catheter Ablation

Kenichiro Otomo, MD; Mario D. Gonzalez, MD; Karen J. Beckman, MD; Hiroshi Nakagawa, MD, PhD; Anton E. Becker, MD; Nayyar Shah, MD; Kagari Matsudaira, MD; Zulu Wang, MD; Ralph Lazzara, MD; Warren M. Jackman, MD

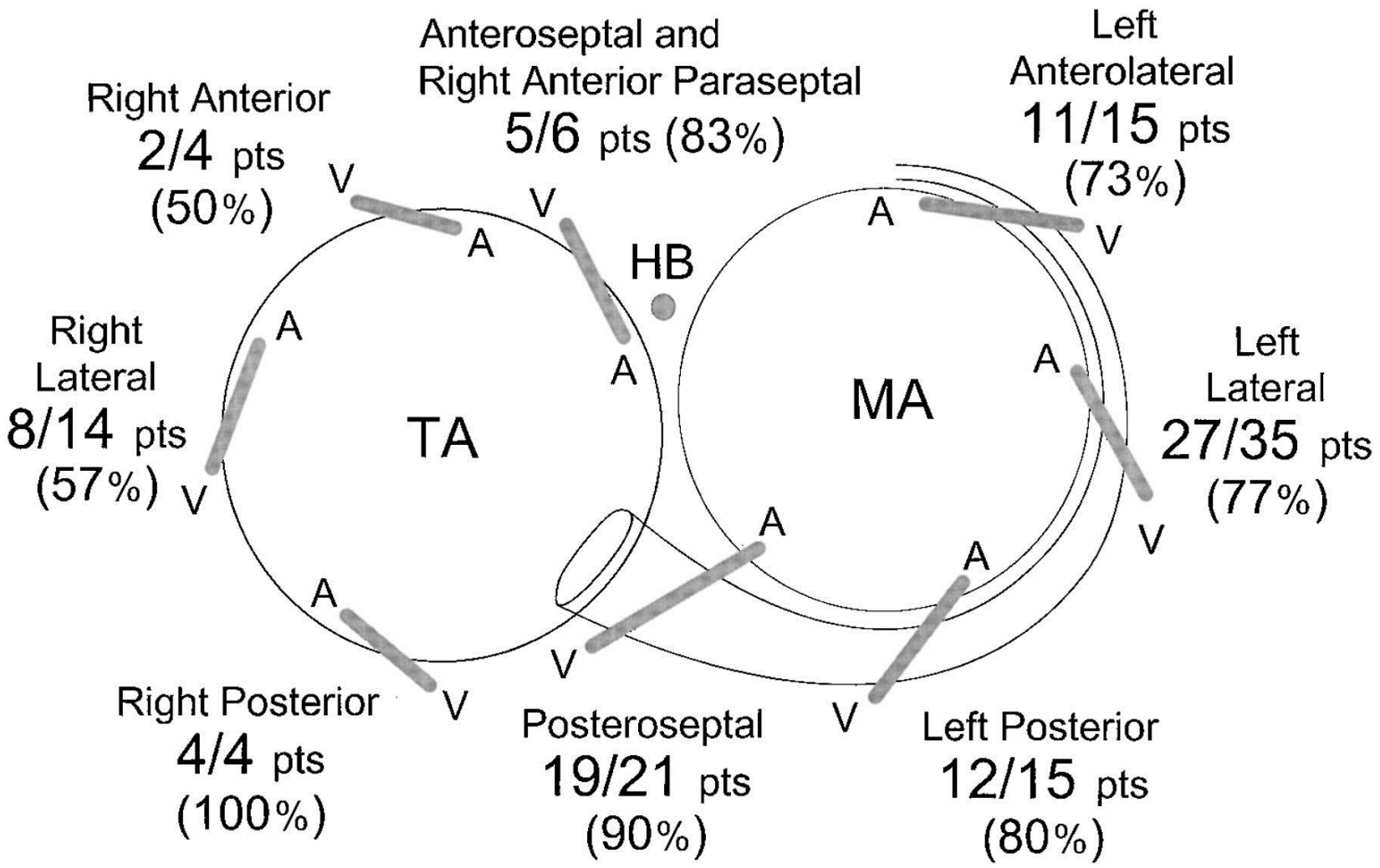
Background—The purpose of this study was to determine how often accessory atrioventricular (AV) pathways (AP) cross the AV groove obliquely. With an oblique course, the local ventriculoatrial (VA) interval at the site of earliest atrial activation (local-VA) and the local-AV interval at the site of earliest ventricular activation (local-AV) should vary by reversing the direction of the paced ventricular and atrial wavefronts, respectively.

Methods and Results—One hundred fourteen patients with a single AP were studied. Two ventricular and two atrial pacing sites on opposite sides of the AP were selected to reverse the direction of the ventricular and atrial wavefronts along the annulus. Reversing the ventricular wavefront increased local-VA by $15 ms in 91 of 106 (91%) patients. With the shorter local-VA, the ventricular potential overlapped the atrial potential along a 17.268.5-mm length of the annulus. No overlap occurred with the opposite wavefront. Reversing the atrial wavefront increased local-AV by $15 ms in 32 of 44 (73%) patients. With the shorter local-AV, the atrial potential overlapped the ventricular potential along an 11.968.9-mm length of the annulus. No overlap occurred with the opposite wavefront. Mapping during longer local-VA or local-AV identified an AP potential in 102 of 114 (89%) patients. Catheter ablation eliminated AP conduction in all 111 patients attempted (median, 1 radiofrequency application in 99 patients with an AP potential versus 4.5 applications without an AP potential).

Conclusions—Reversing the direction of the paced ventricular or atrial wavefront reveals an oblique course in most APs and facilitates localization of the AP potential for catheter ablation.

***Circulation*. 2001;104:550-556**

Figure 7. Orientation of oblique course for 114 APs separated into 8 anatomic regions.



Otomo K et al. Circulation 2001;104:550-556

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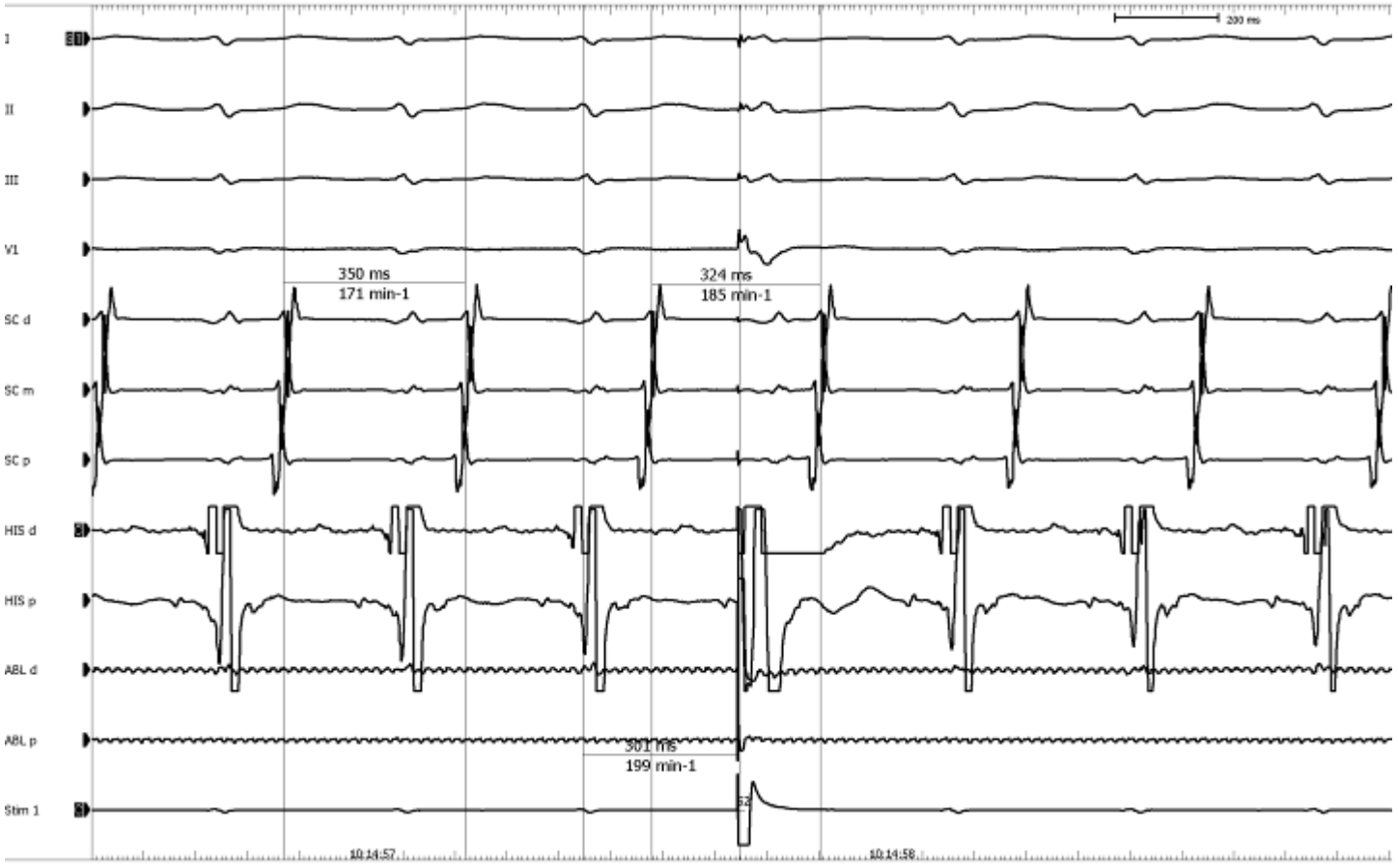
Atrial anticipation with late ventricular premature stimulation when His is refractory



V is part of the circuit

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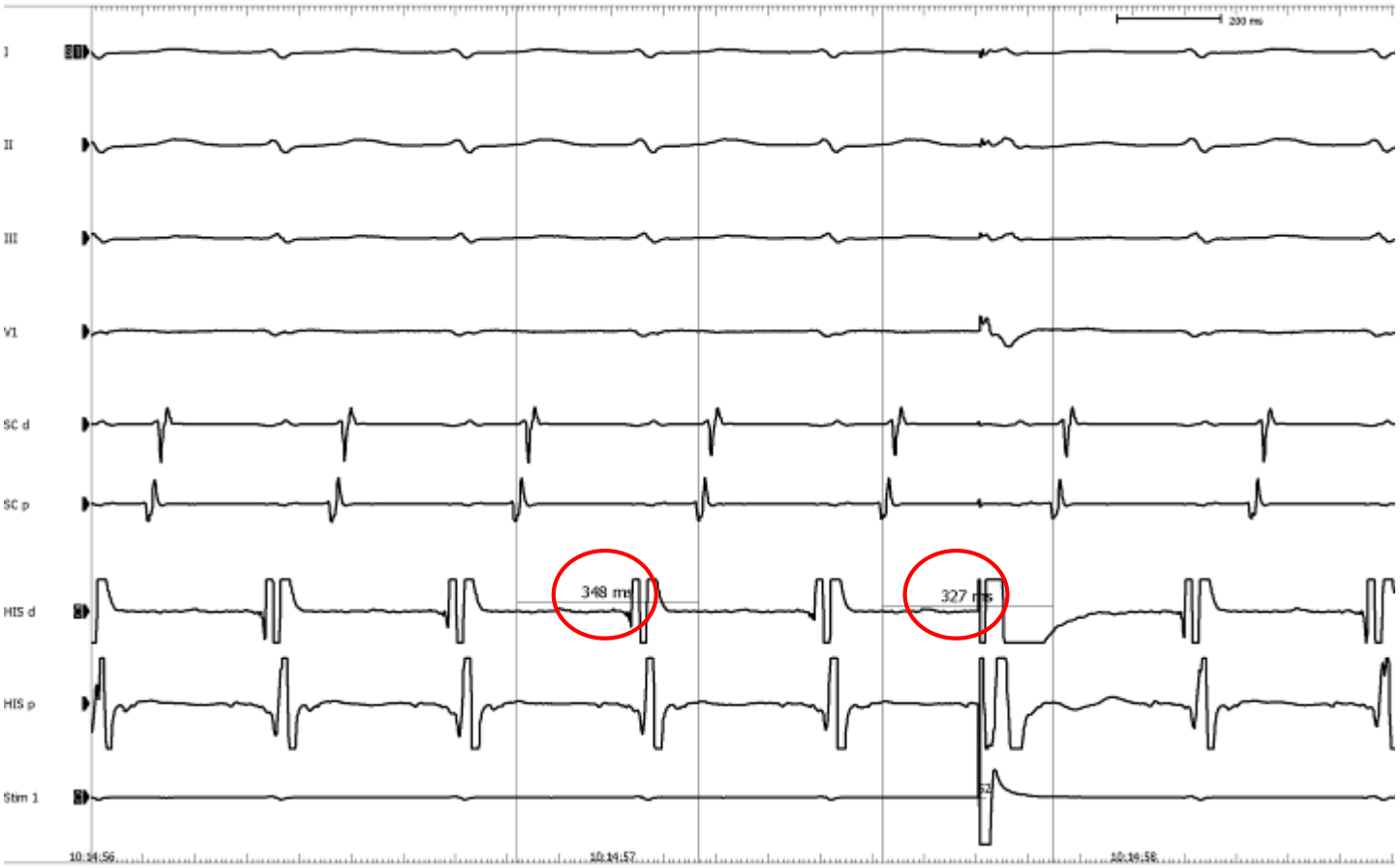
More premature stimulation



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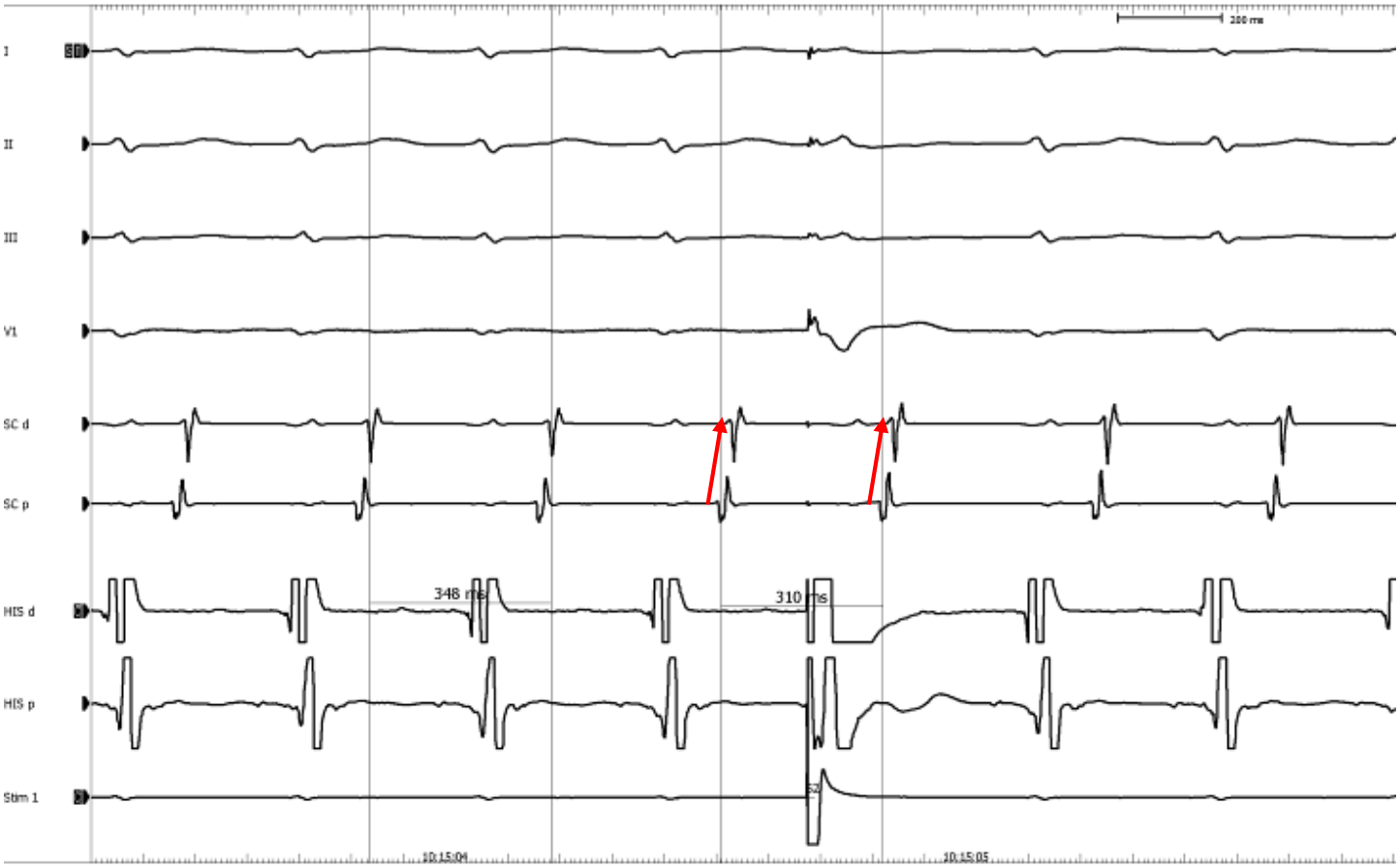
Same retrograde activation sequence = same retrograde pathway



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Early V not conducted retrogradly stops the tachycardia !

V is part of the circuit

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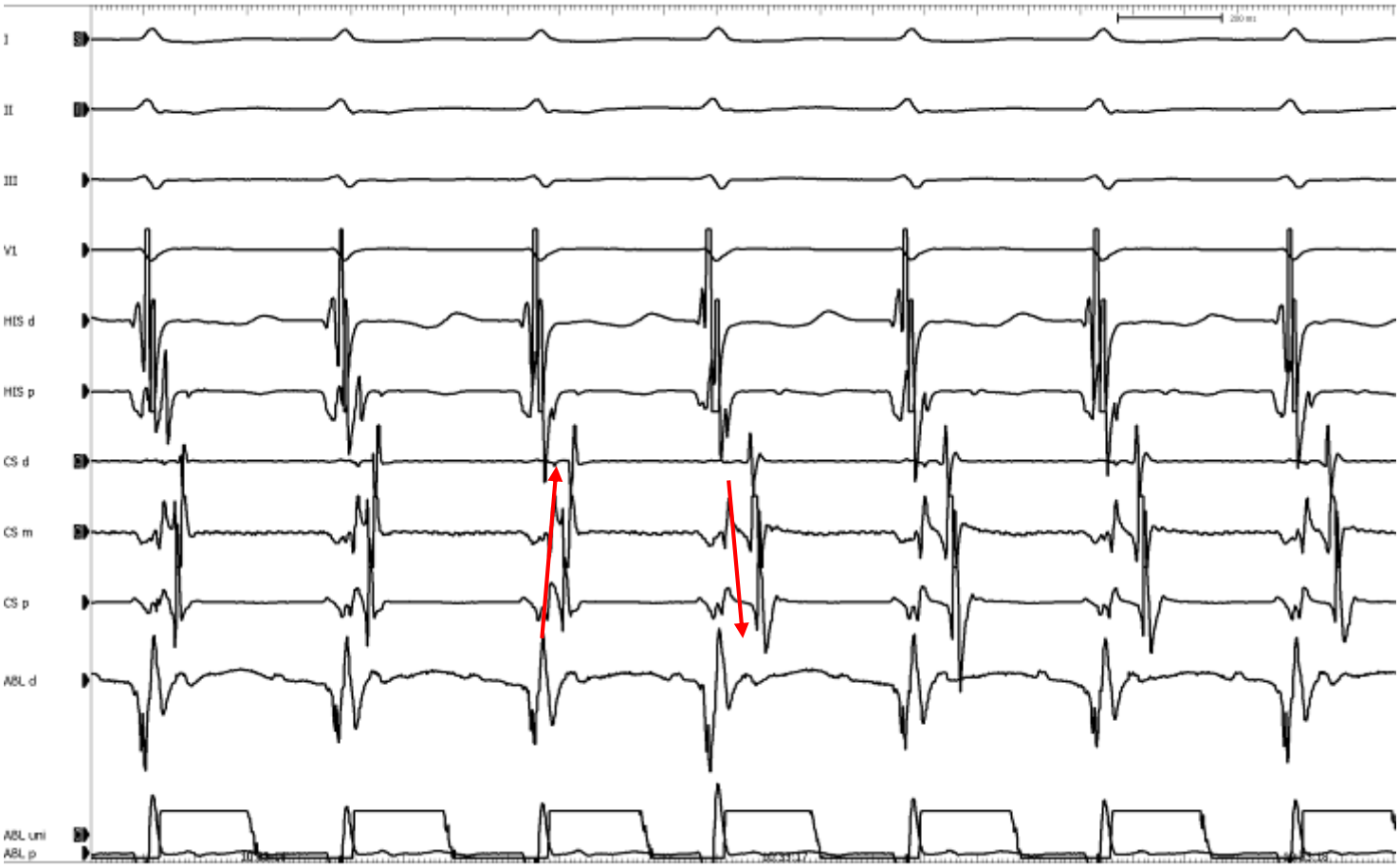
Shift in retrograde activation sequence after induction: 2 left retrograde pathways !



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Shift

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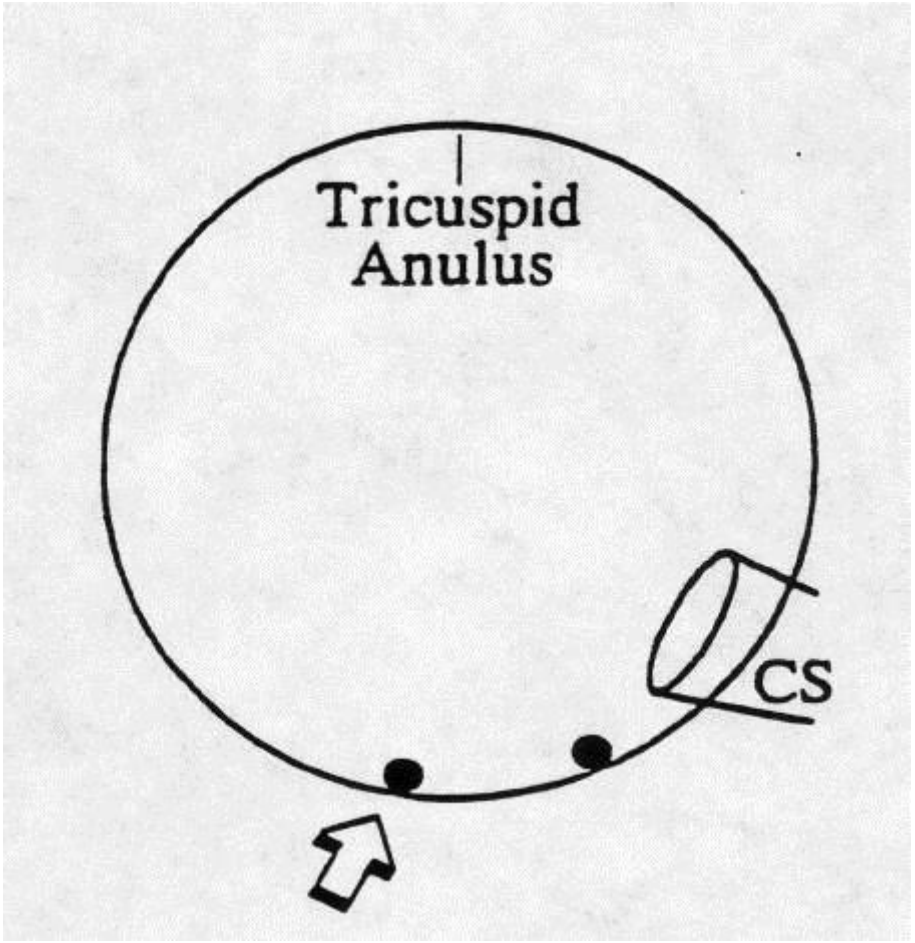
Ebstein / Multiple right APs



Jackman W.

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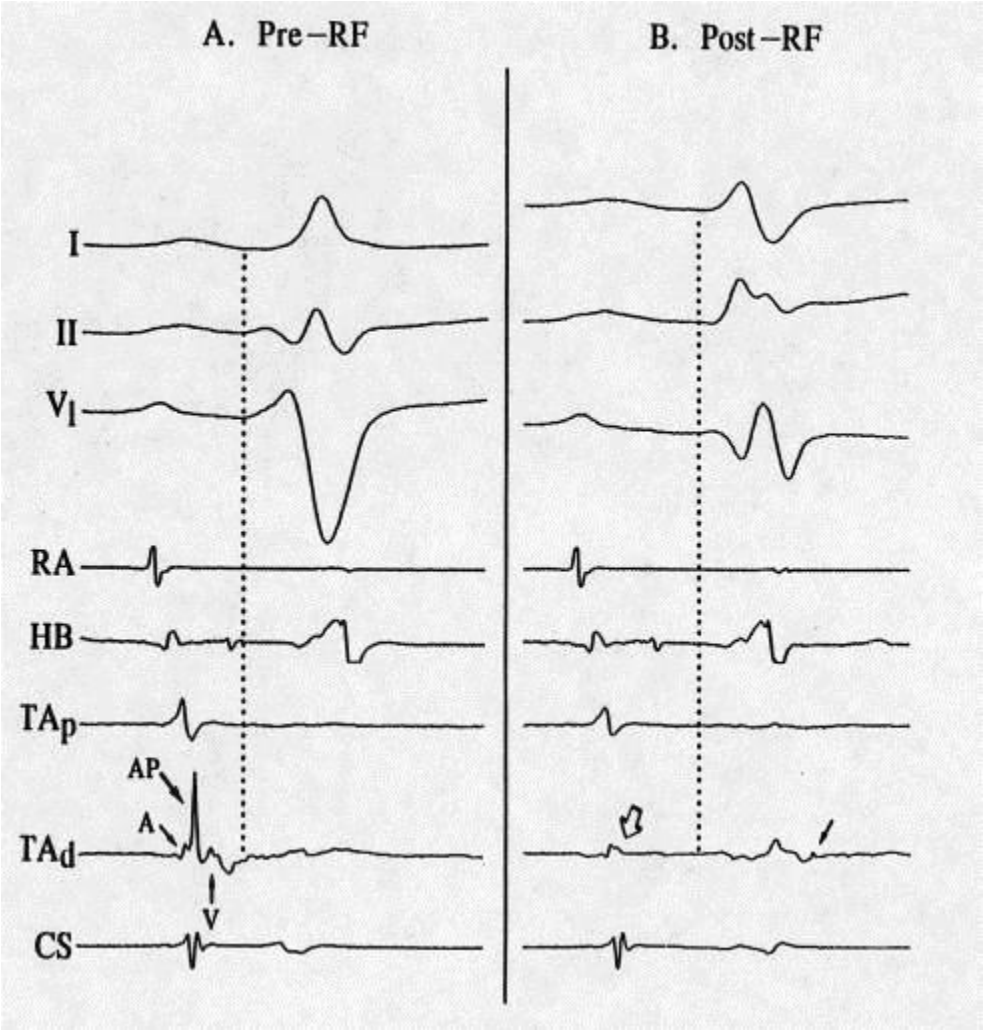
Ebstein / Successful ablation site



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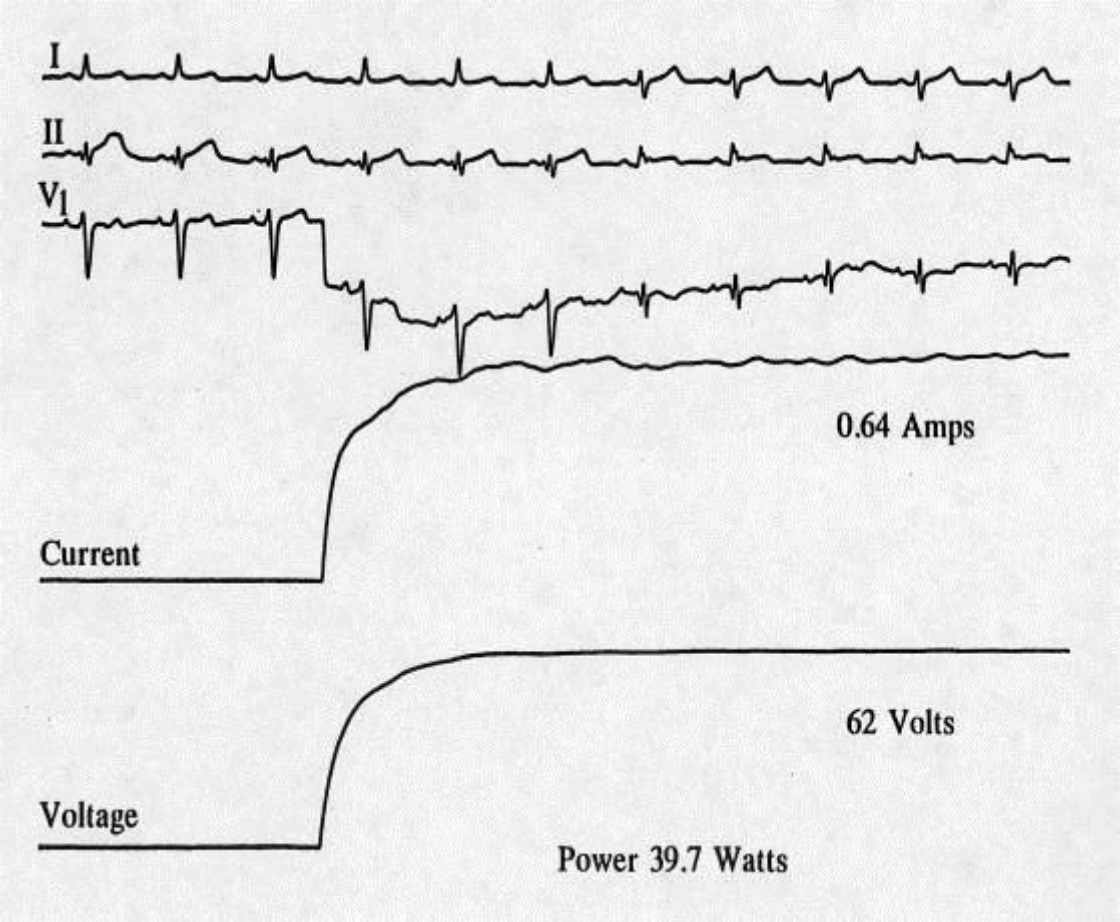
Ebstein: radiofréquence delivery



Jackman W.

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AVRT - AVNRT ablation results

TABLE 2. Results of Catheter Ablation

Arrhythmia	No. of Pts	Median No. (Range) of RF Applications	No. of Pts Requiring Second Procedure for Success	Success With Investigational System	Overall Success	Recurrence*
AVJ	121	4 (1–57)	3 (3%)	108 (89%)	121 (100%)	2 (2%)
AVNRT	373	6 (1–73)	3 (1%)	348 (93%)	362 (97%)	16 (5%)
AP	500	6 (1–98)	24 (5%)	398 (80%)	465 (93%)	31 (8%)
LFW	270	5 (1–77)	9 (3%)	224 (82%)	257 (95%)	7 (3%)
RFW	92	8 (1–98)	6 (7%)	66 (72%)	83 (90%)	9 (14%)
Posteroseptal	98	6 (1–46)	8 (8%)	73 (74%)	86 (88%)	9 (12%)
Septal	40	6 (1–31)	1 (3%)	35 (88%)	39 (98%)	6 (17%)
Multiple APs	36	16 (1–54)	8 (22%)	24 (67%)	31 (86%)	5 (21%)
Multiple targets	20	16 (2–58)	4 (20%)	11 (55%)	17 (85%)	2 (17%)
Total	1050	6 (1–98)	42 (4%)	889 (85%)	996 (95%)	56 (6%)

Pts indicates patients; LFW, left free wall; and RFW, right free wall.

*Analysis of arrhythmia recurrence was confined to those patients in whom success was achieved with the investigational ablation system.

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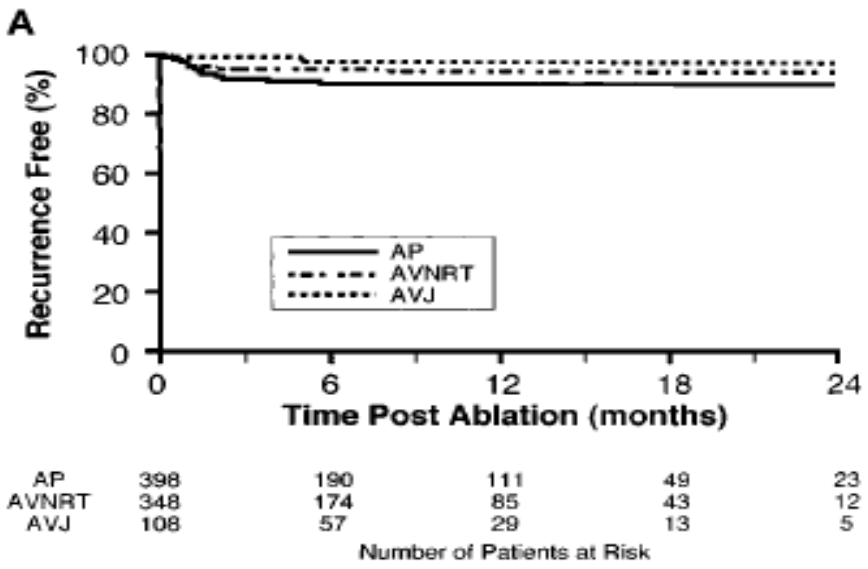
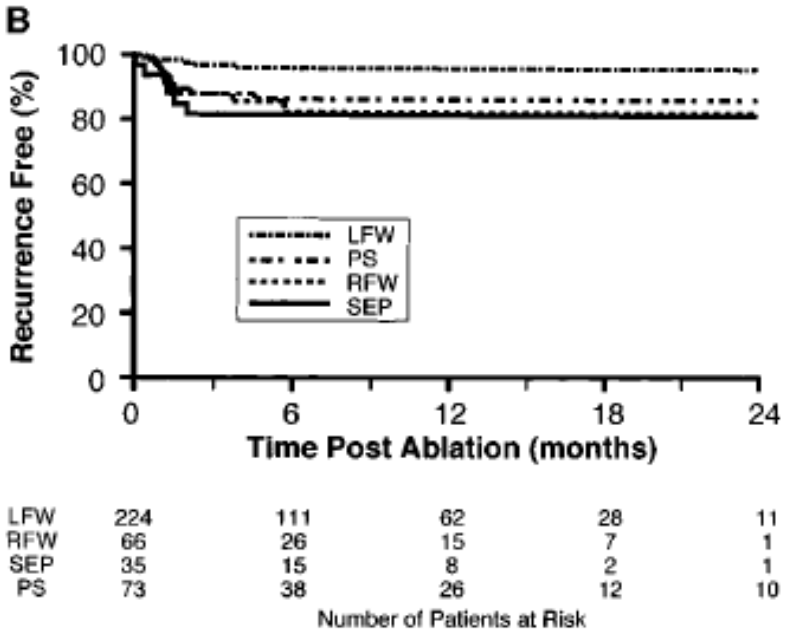
Freedom from arrhythmia recurrence after ablation





Calkins H. et al Circulation 1999; 99: 262-270

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Independent risk factor for recurrence after WPW syndrome ablation

TABLE 7. Stepwise Multivariate Cox Proportional Hazards Model: Recurrence

Predictor	Partial Risk Ratio	95% CI	Model *P*
Septal AP, Y/N	4.32	1.78, 10.48	0.001
Multiple APs, Y/N	4.21	1.61, 10.95	0.003
RFW AP, Y/N	3.08	1.44, 6.58	0.004
Posteroseptal AP, Y/N	2.67	1.25, 5.70	0.011

RFW AP indicates right free wall AP.

Calkins H. et al Circulation 1999; 99: 262-270

AVRT – AVNRT ablation complications

TABLE 4. Complications

Complication Type	No. of Pts	% of Pts
Major complications		
Periprocedural death	3	0.30
Stroke	2	0.20
Complete AV block	10	1.00
Tamponade	6	0.60
Valve damage*	1	0.10
Myocardial infarction	1	0.10
Coronary artery spasm	1	0.10
Pneumothorax	1	0.10
Thrombus/embolic event	4	0.40
Coronary sinus perforation	1	0.10
Radiation injury	1	0.10
Femoral artery laceration	1	0.10
Other complications		
Pericardial effusion	20	1.90
Pericarditis	4	0.38
Hematoma	32	3.05
Pleural effusion	4	0.38
Hypotension	6	0.57
Chest pain	4	0.38
Vasovagal reaction	3	0.29
Respiratory depression	2	0.19
Temperature elevation	1	0.10
Pneumonia	2	0.19
Brachial plexus injury	1	0.10
Groin pain	1	0.10
Other AV block†	21	2.00

Pts indicates patients.

*At least 2 grades of increase in regurgitant fraction.

†First, second, or third-degree AV block not requiring a permanent pacemaker.

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Thank You

Any question ?

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