Eelectrophysiological study for PSVT

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Workflow of EP study for PSVT

■ Identification of presence of accessory pathway

- Antegrade extra-nodal pathway - Atrial extra stimulation(AES): preexcitation
- Retrograde extra-nodal pathway - Ventricular extra stimulation(VES): eccentric or concentric RAAS
- Concentric pattern - Para-Hisian pacing, Differential Base vs. Apex pacing, Administration of adenosine

■ SVT induction

- AES, VES, Burst, Isoproterenol
- Comparison of atrial activation sequences during ventricular pacing and tachycardia

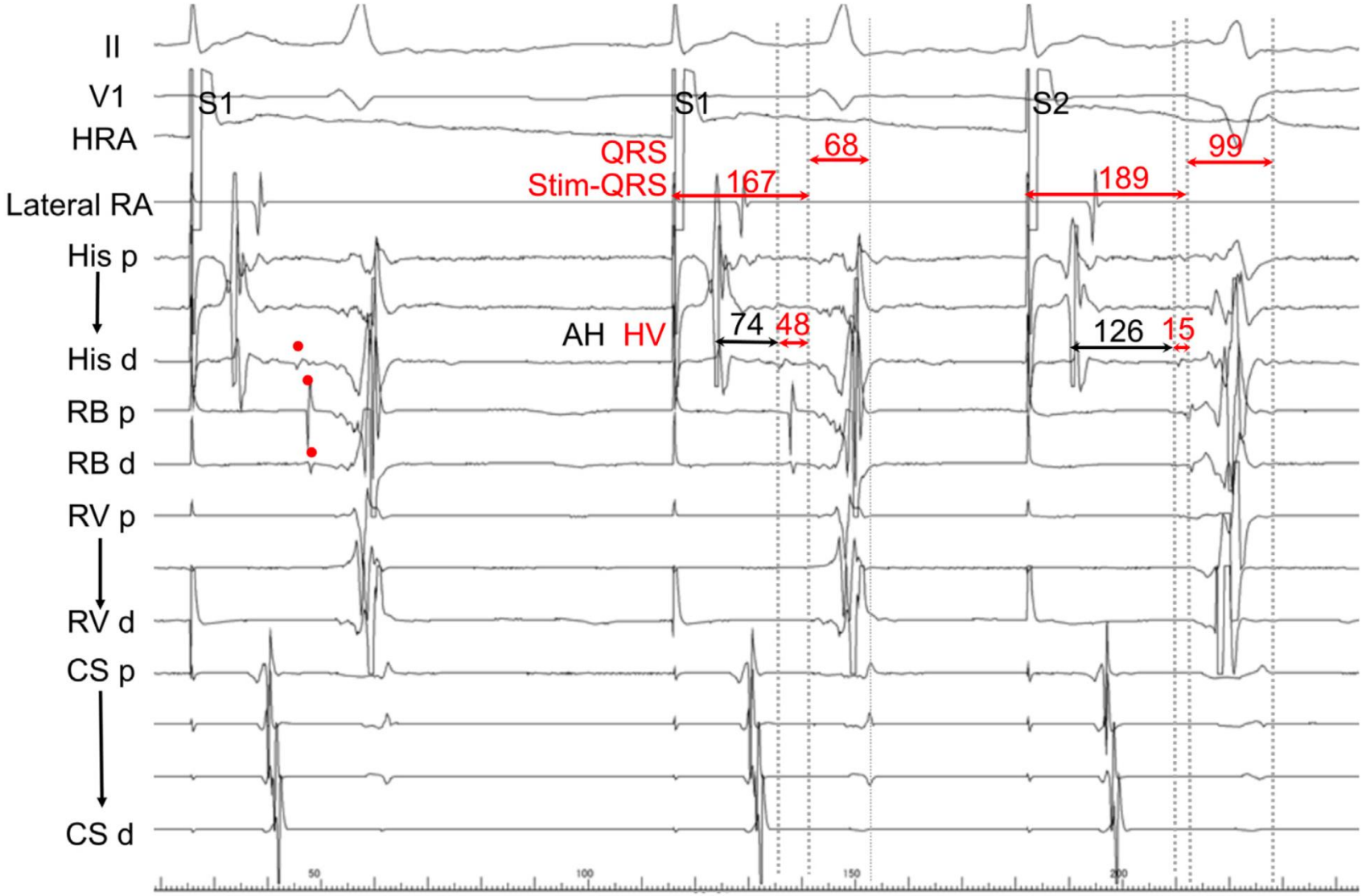
■ Differential - Pacing maneuvers

- Ventricular : Single or double PVC, Entrainment
- Atrial : Single PAC, Entrainment

■ Ablation

- Mapping

Identification of antegrade extra-nodal pathway

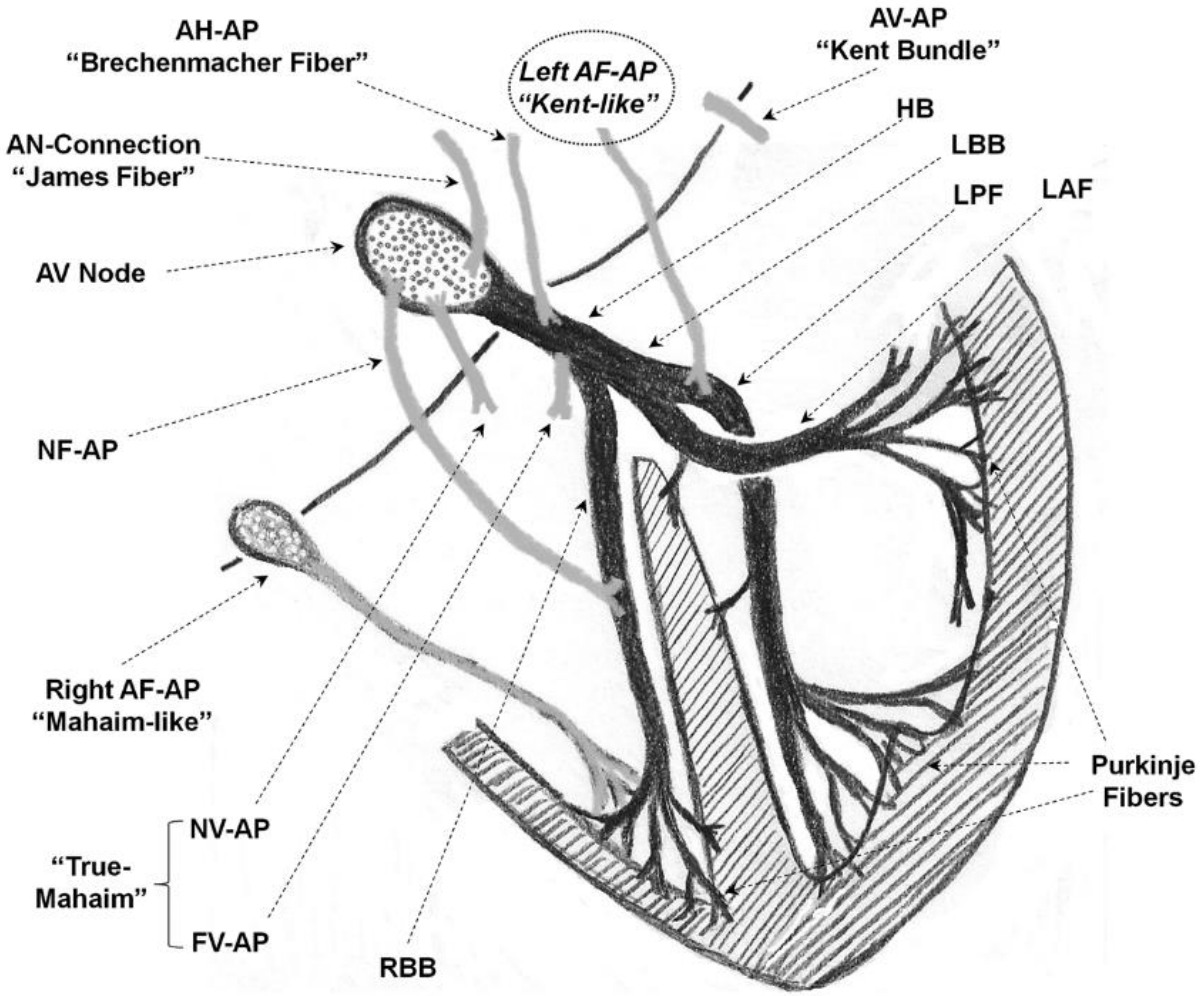


Short HV interval
- Catheter misplacement
- Preexcitation

Stim to delta interval
Fixed
– All or none pathway
Prolongation
– Decremental pathway

JACC:CLINICALELECTROPHYSIOLOGYVOL.10,NO.7,2024
JULY2024:1760–1769

Atypical bypass tracts

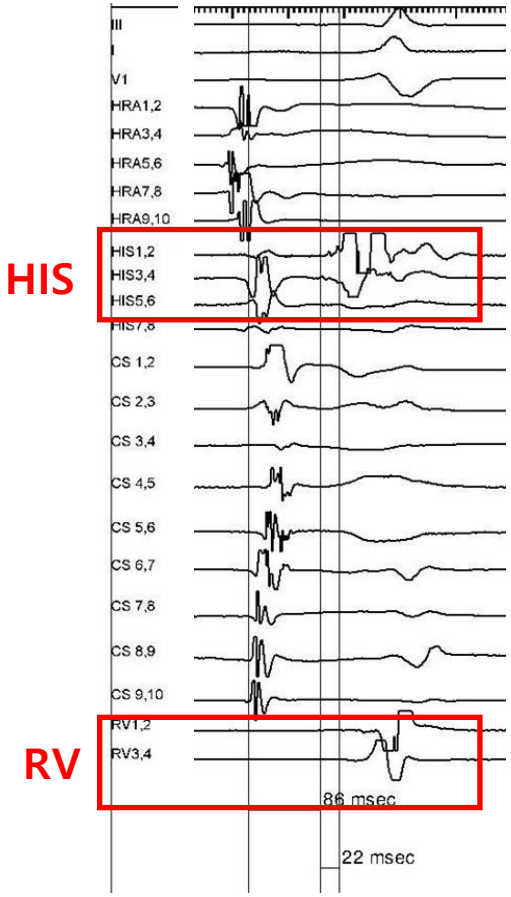


J Cardiovasc Electrophysiol. 2020;31:2238–2242.

Fixed preexcitation

Fasciculoventricular pathway

Sinus beat

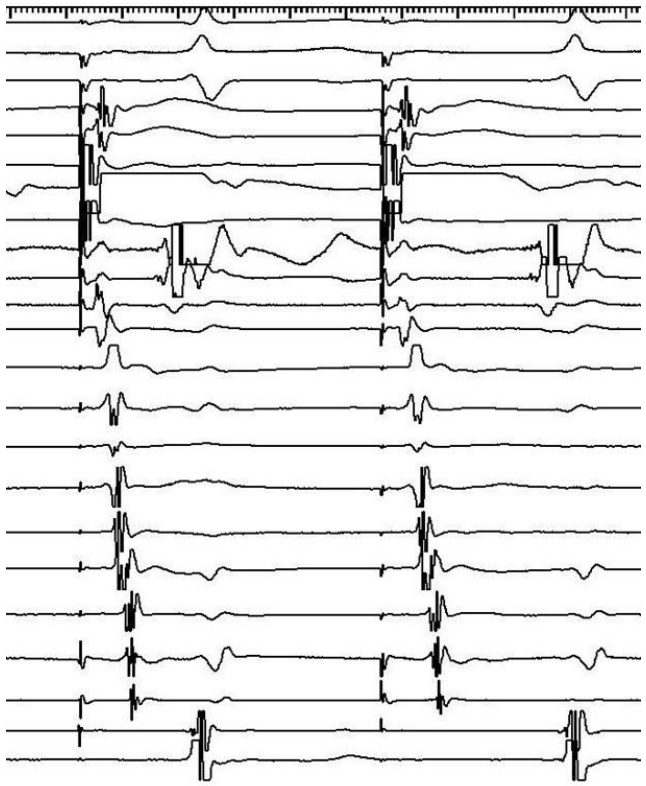


HIS

RV

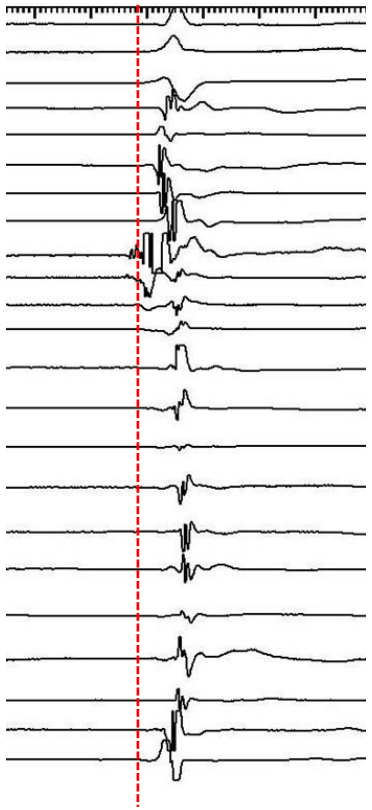
Subtle preexcitation

AES



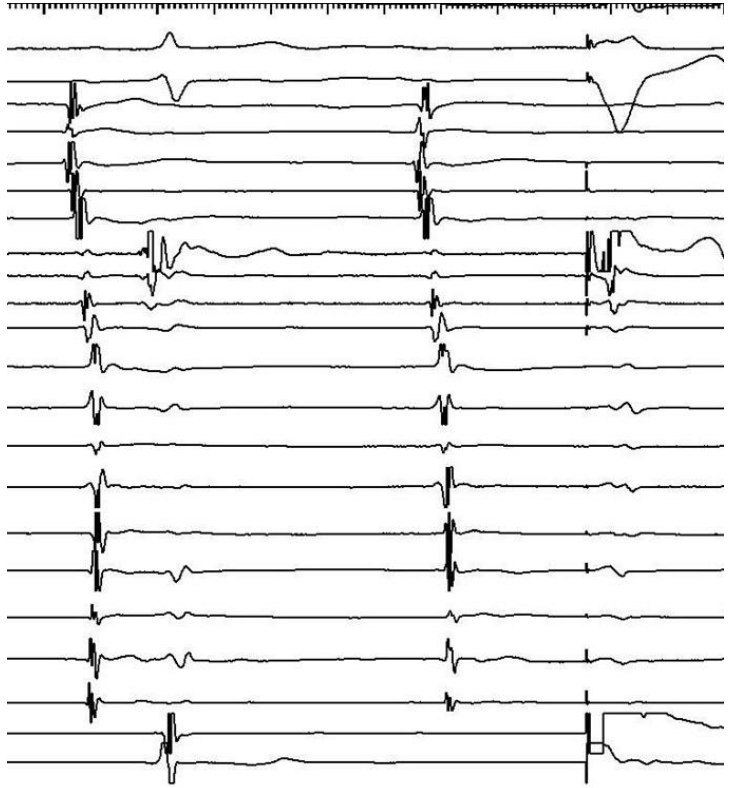
No augumentation

Junction beat



Fixed preexcitation

Adenosine



AV block

Identification of retrograde conduction pathway

Responses to VES

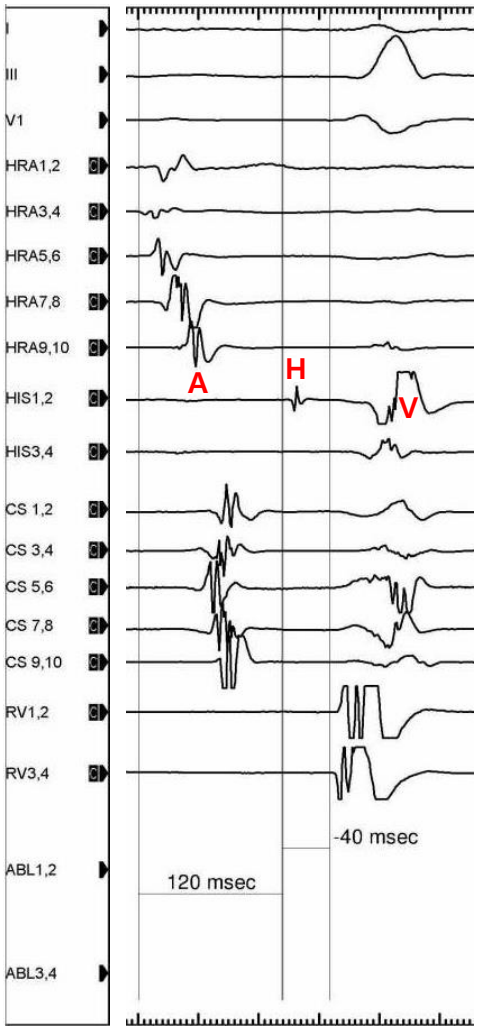
■ AV node

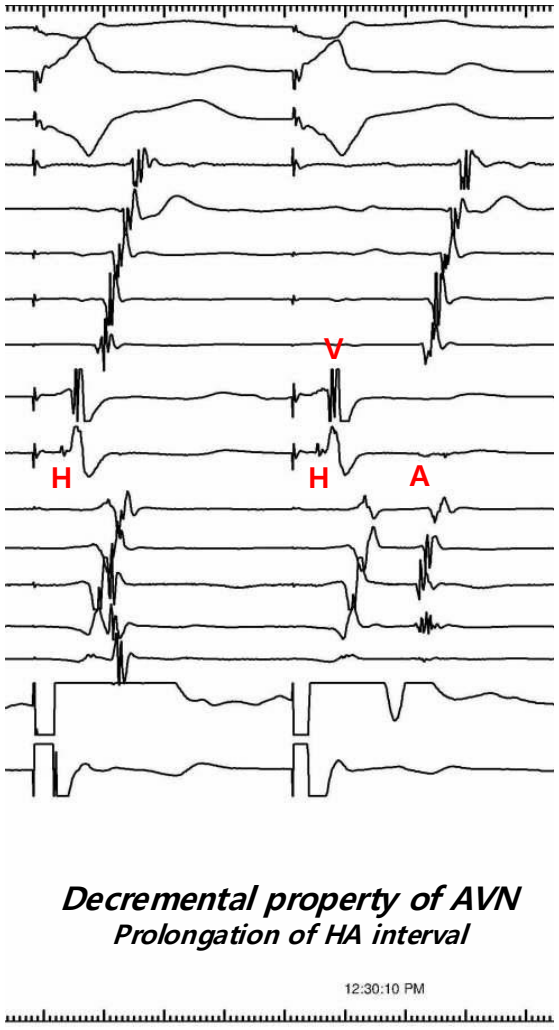
1. Concentric retrograde atrial activation sequence(RAAS)
2. Decremental property

■ Accessory pathway

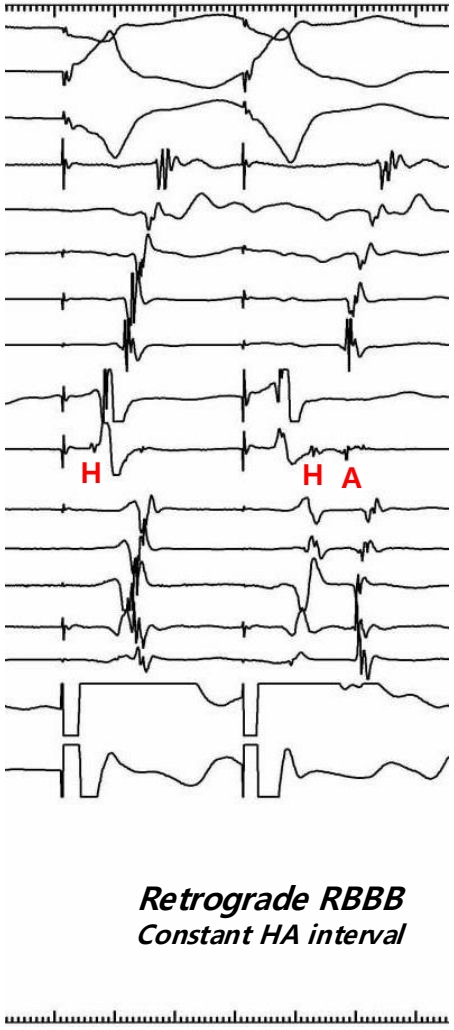
1. Eccentric or concentric RAAS
2. Most of them are all or none(non-decremental)

Ventricular extra-stimulus(VES) pacing





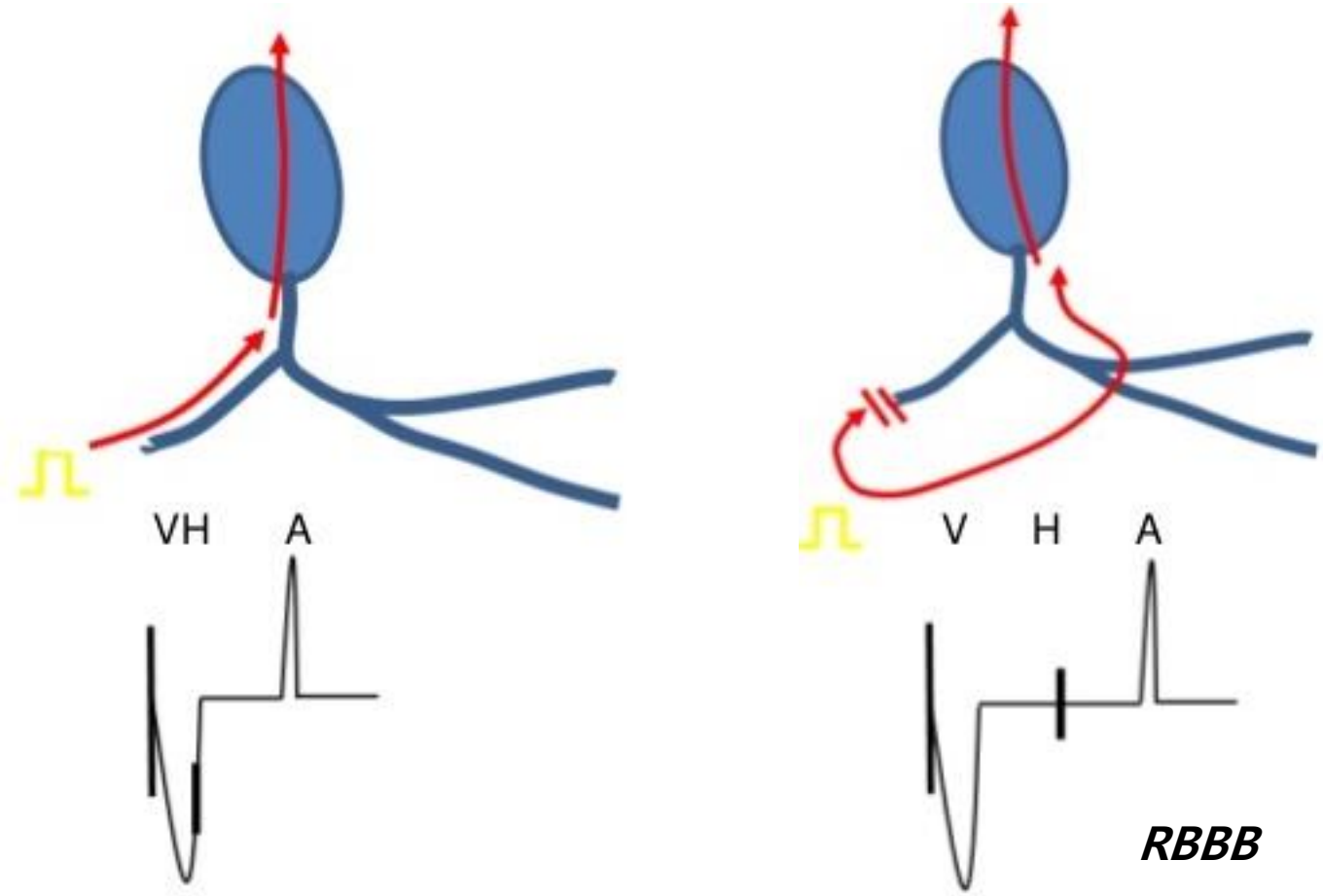
Decremental property of AVN
Prolongation of HA interval



Retrograde RBBB
Constant HA interval

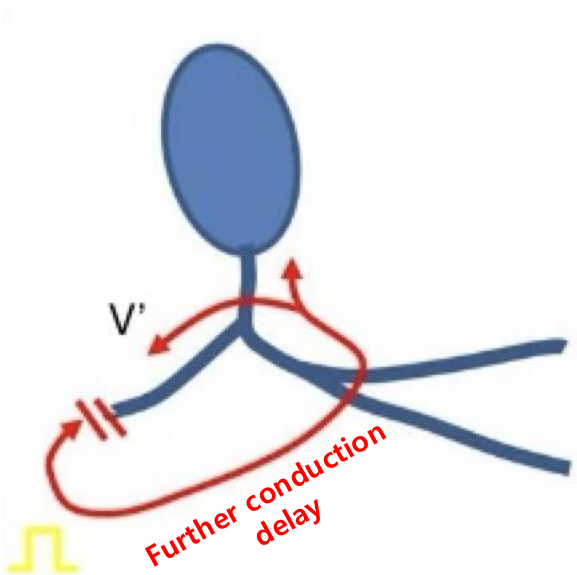
H-H interval – retrograde AV nodal input

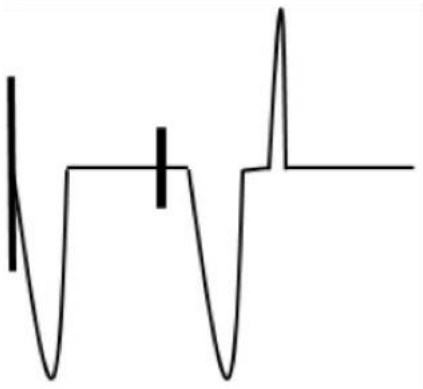
Development of retrograde RBBB



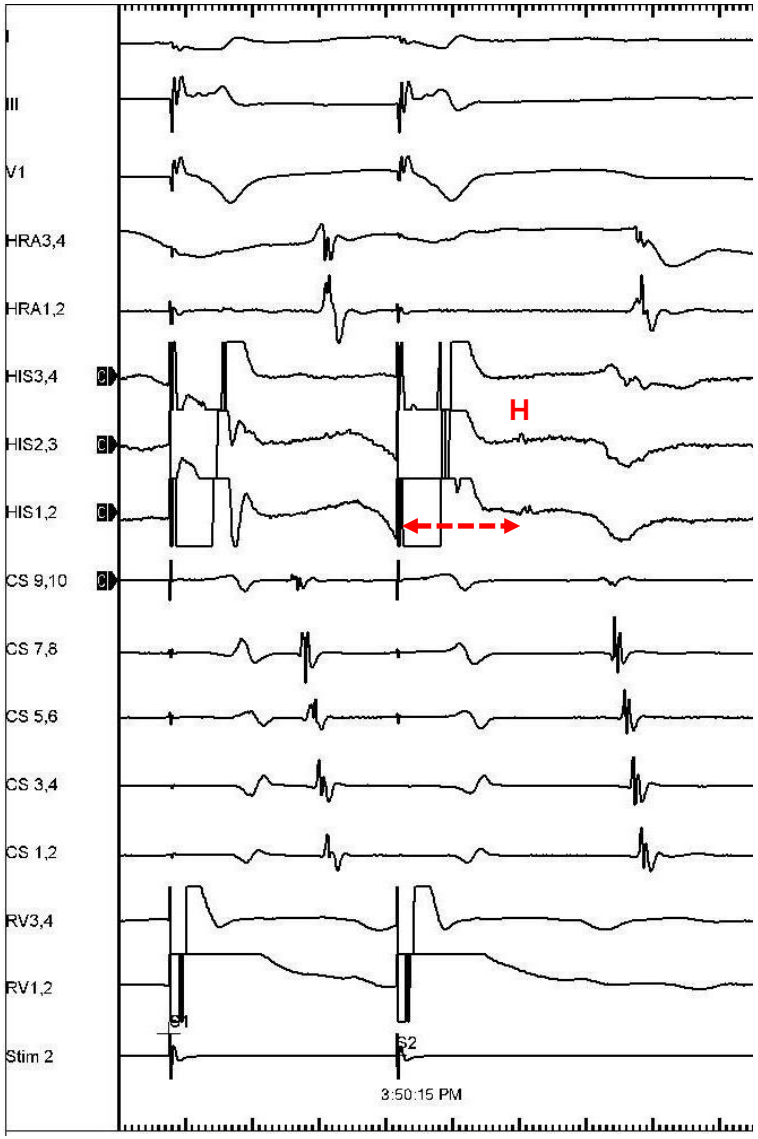
Retrograde AVN conduction - Dependent to His bundle conduction

Bundle Branch Reentrant echo beat

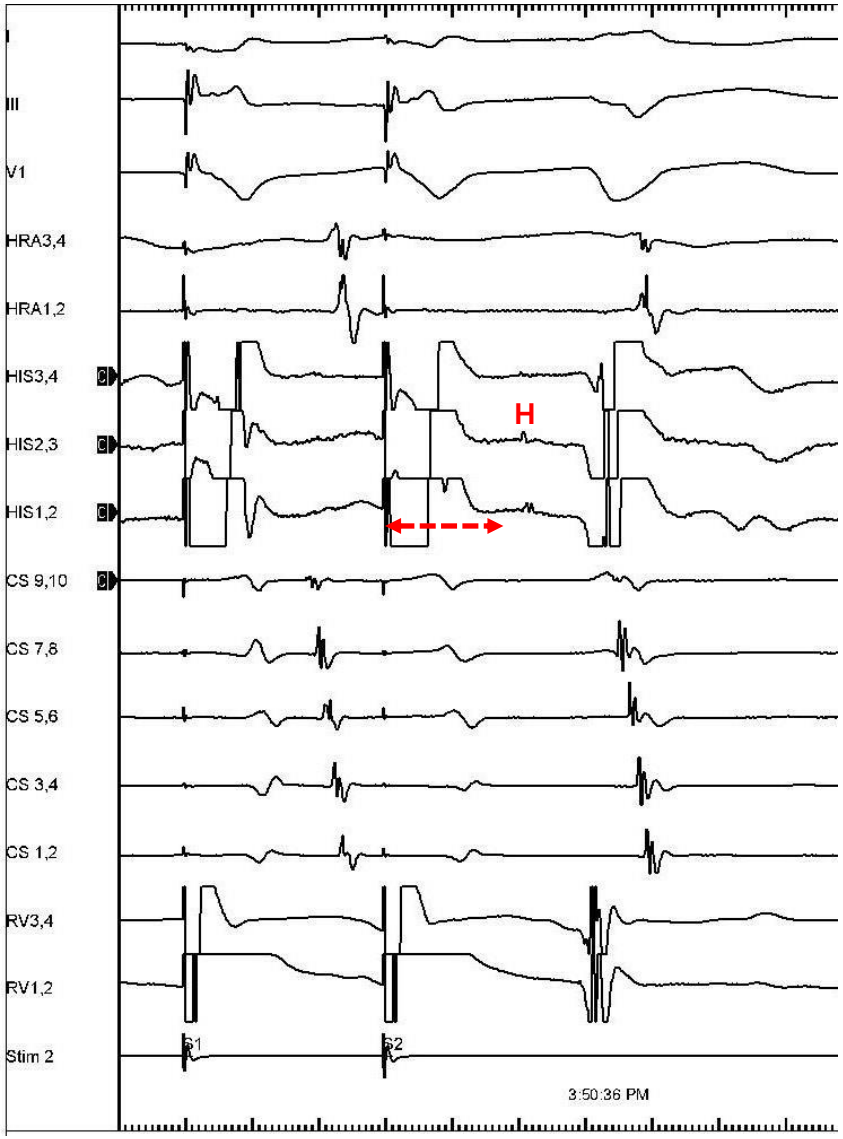


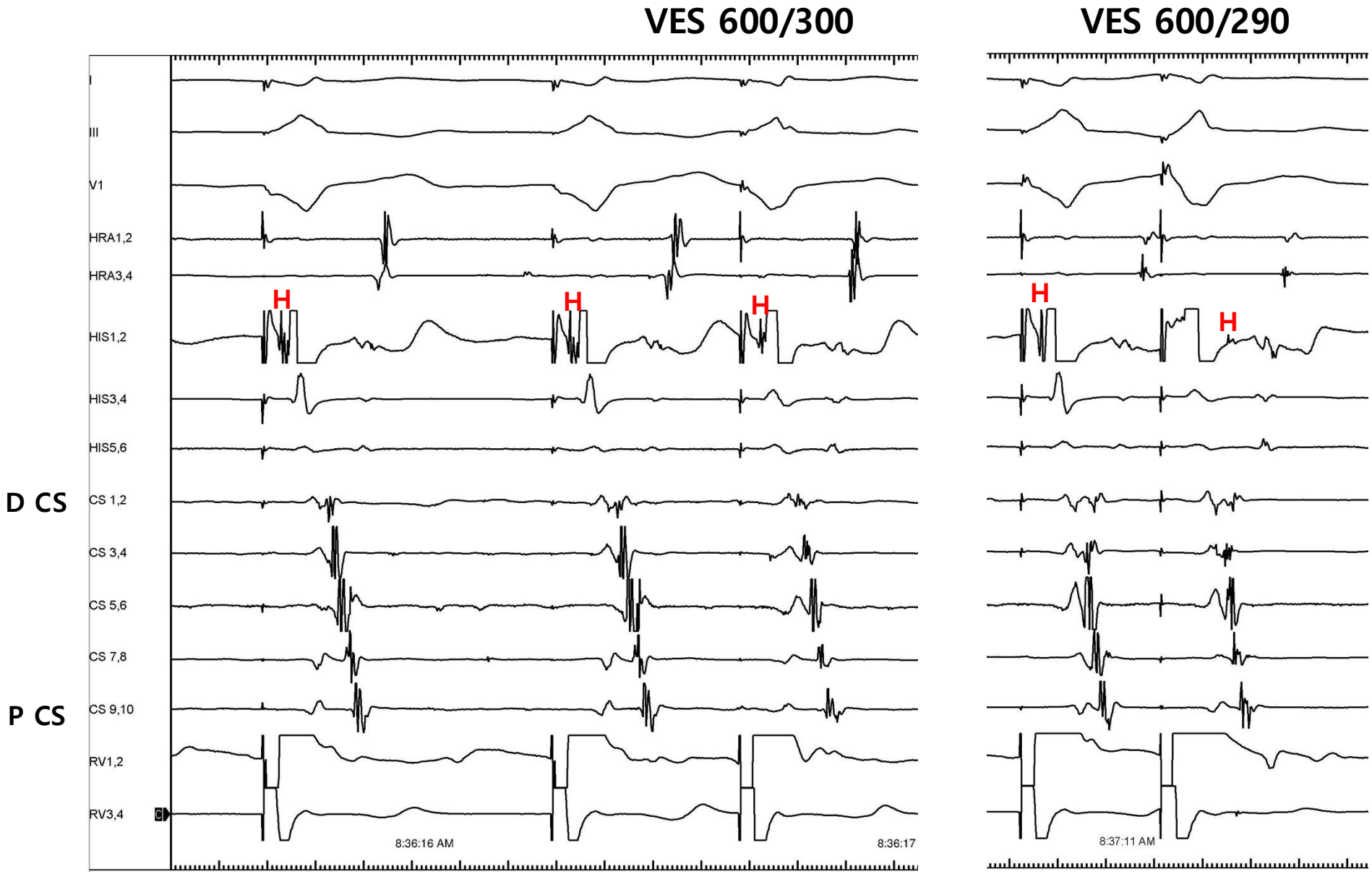


Retrograde RBBB

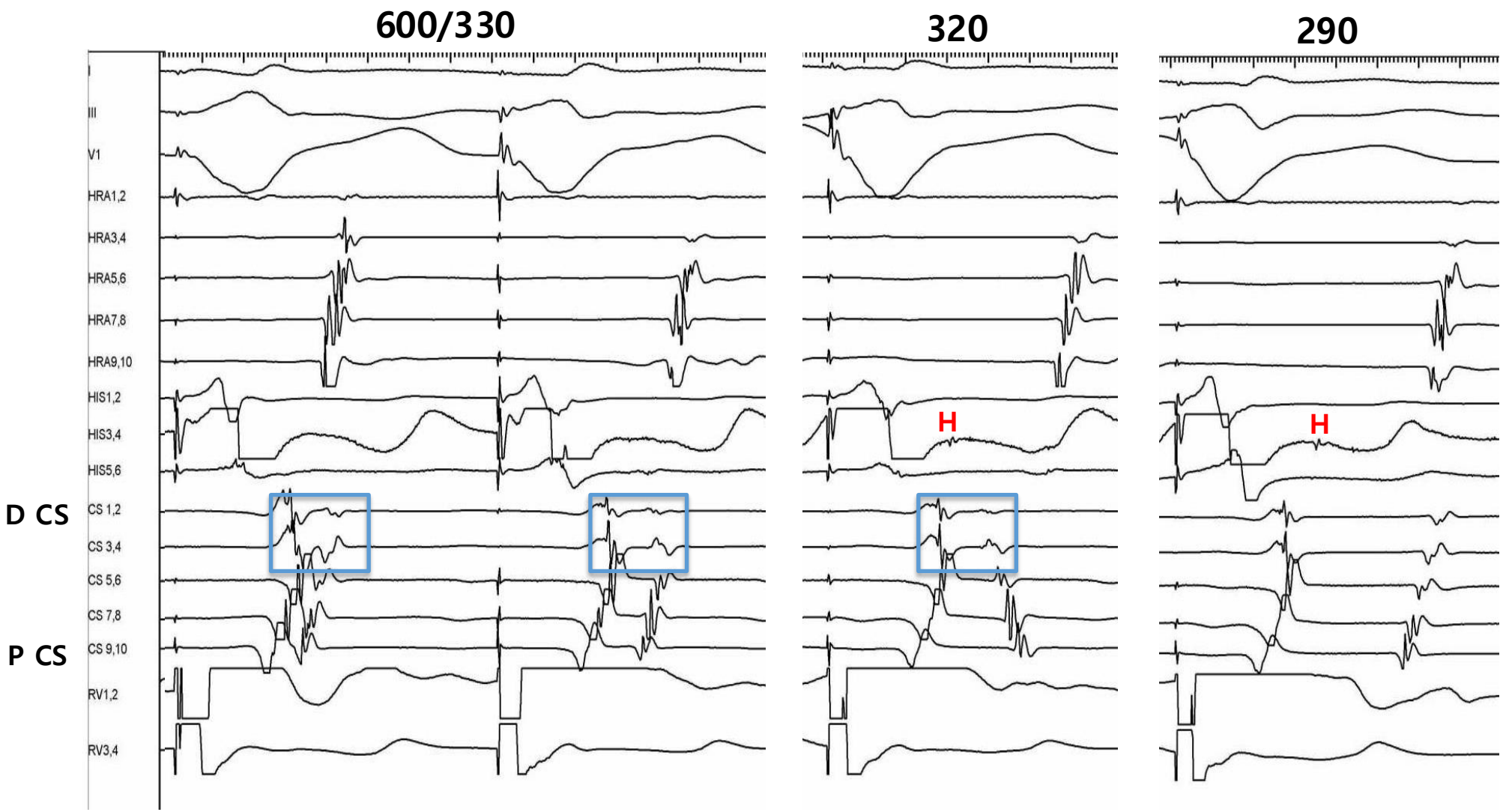


BBR echo beat



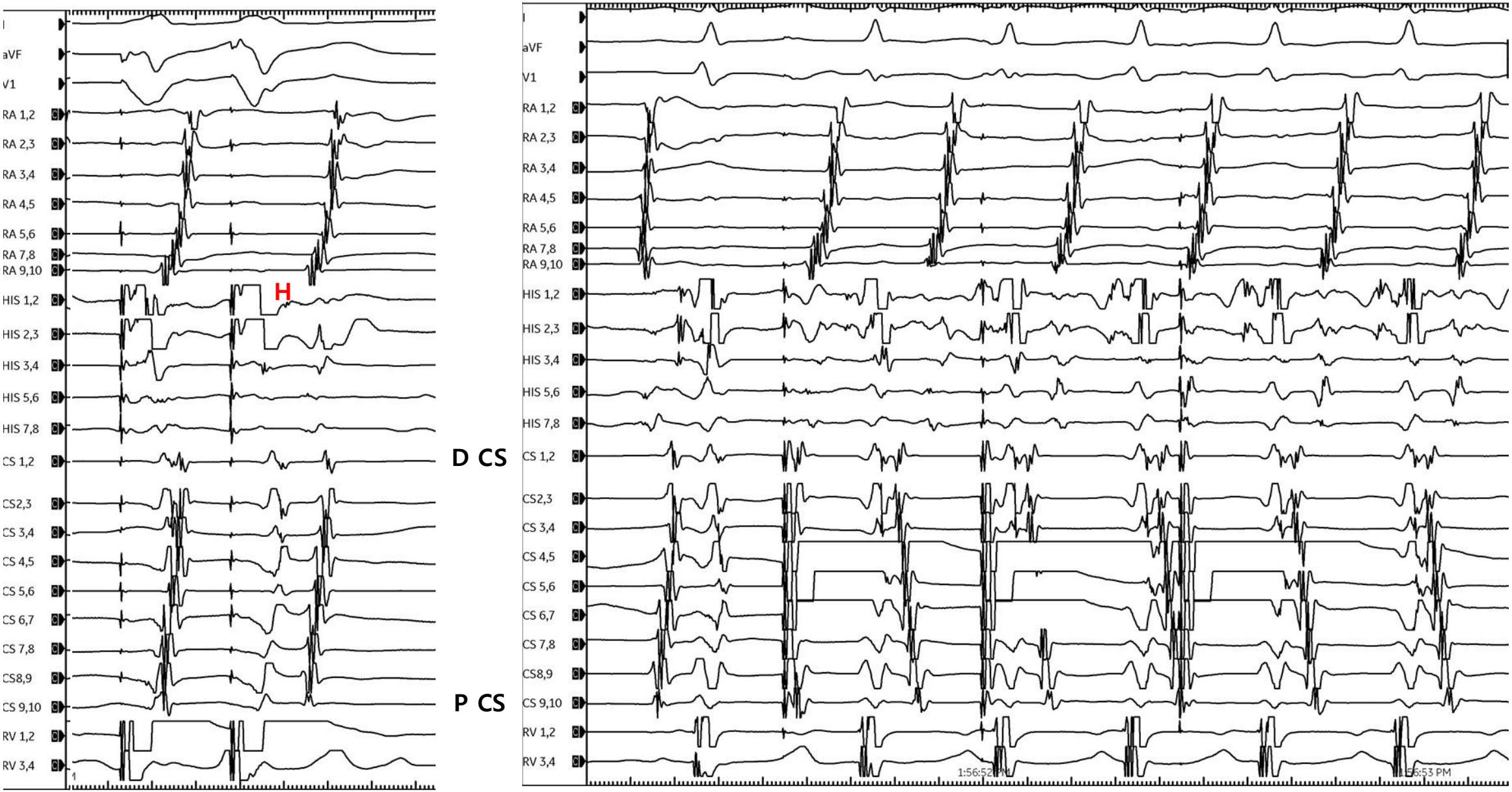


Independent to His bundle activation

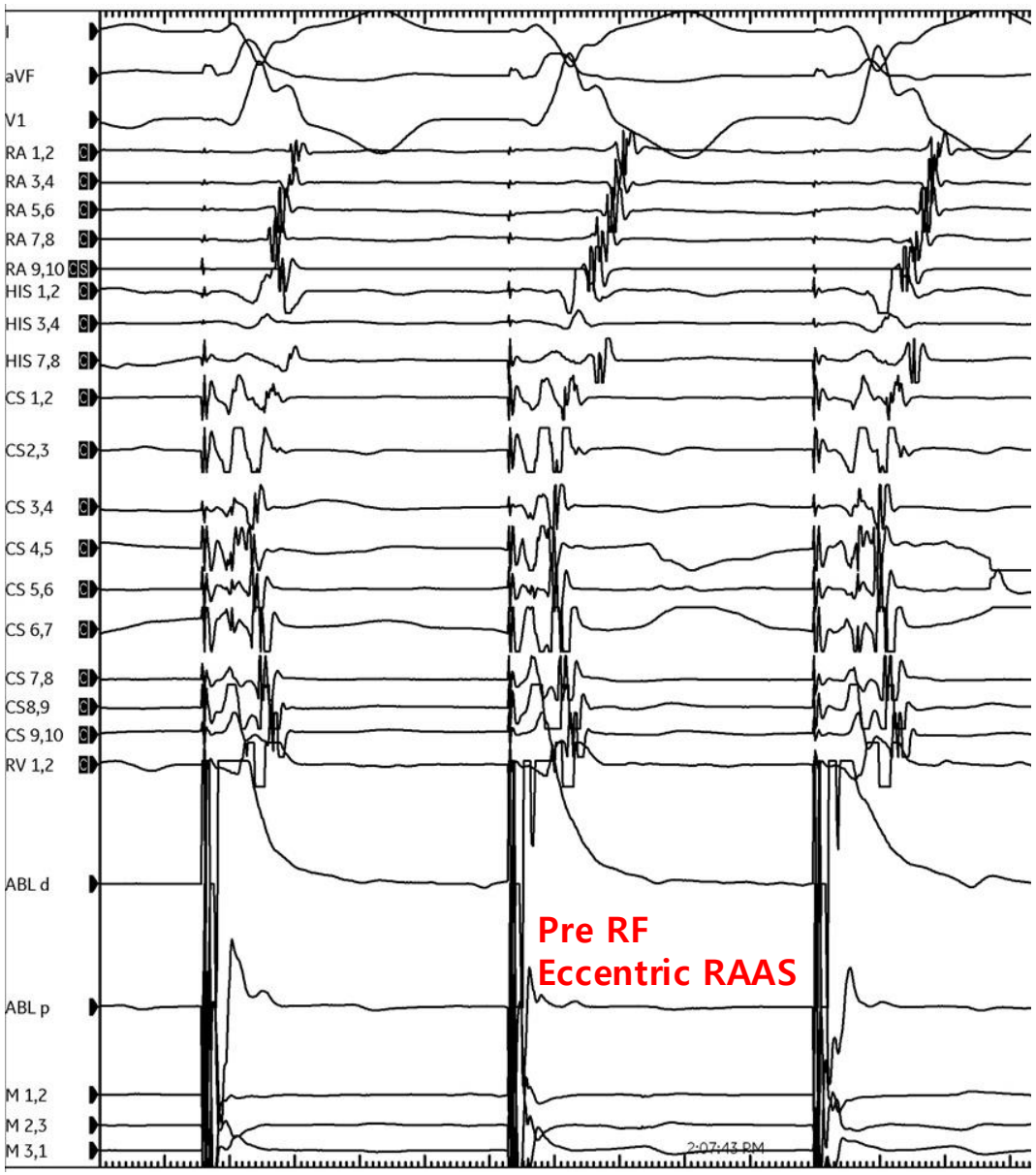

600/330
320
290
I
III
V1
HRA1,2
HRA3,4
HRA5,6
HRA7,8
HRA9,10
HIS1,2
HIS3,4
HIS5,6
D CS
CS 1,2
CS 3,4
CS 5,6
CS 7,8
P CS
CS 9,10
RV1,2
RV3,4
H
H
Fusion – AVN + AP
AP only
AVN only

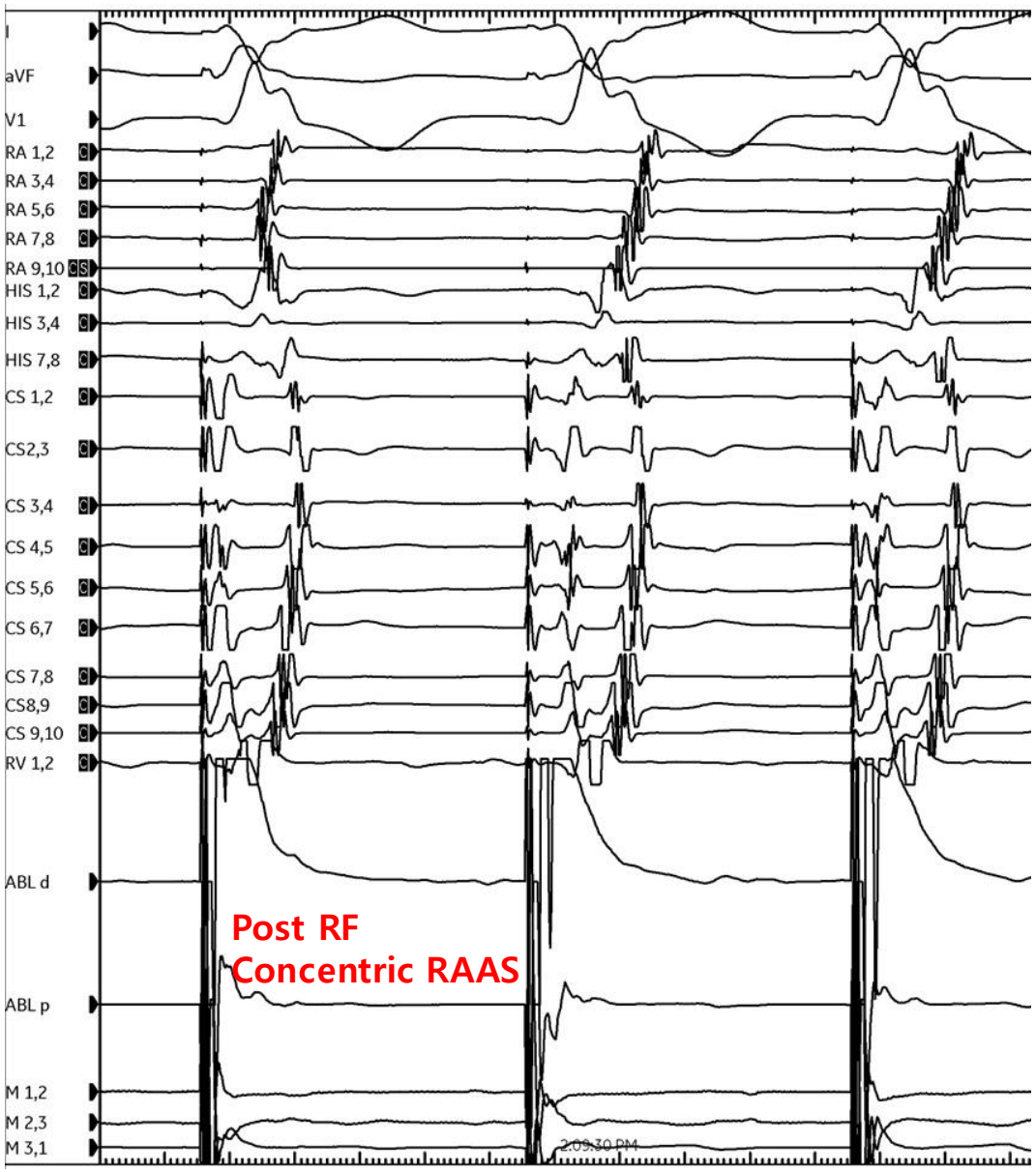
Baseline VES.

Initiation of SVT

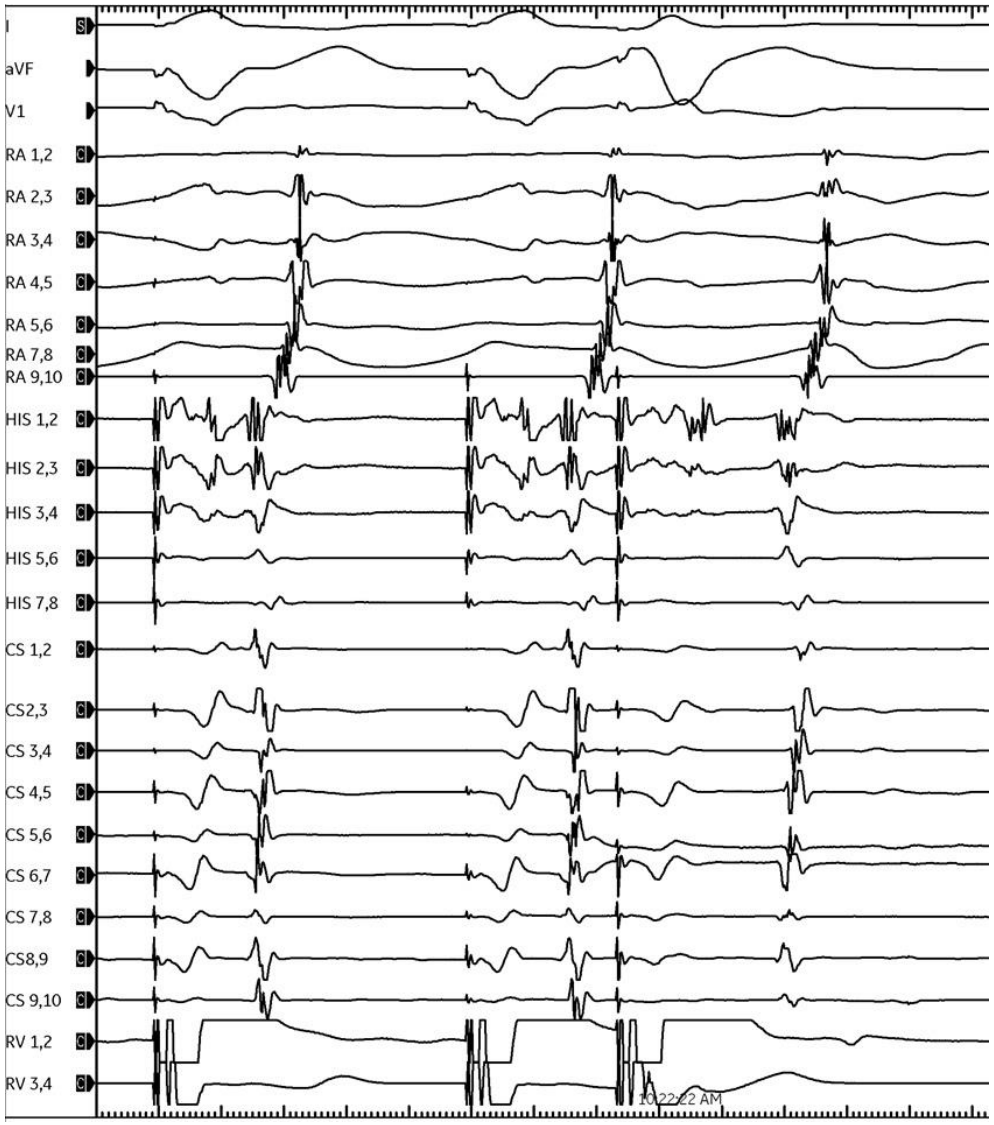


Comparison of LV pacing before and after ablation

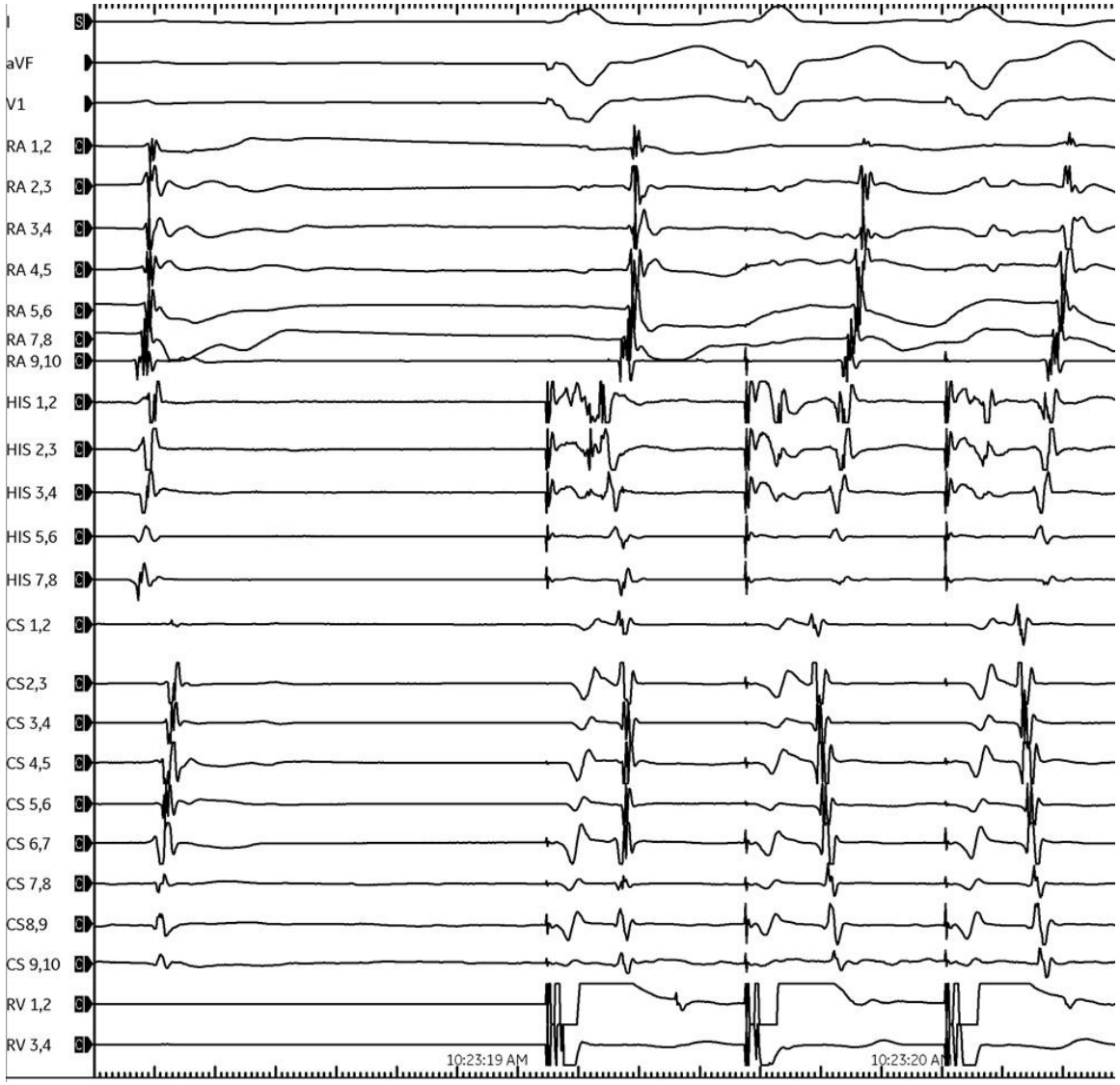




Baseline VES



Adenosine



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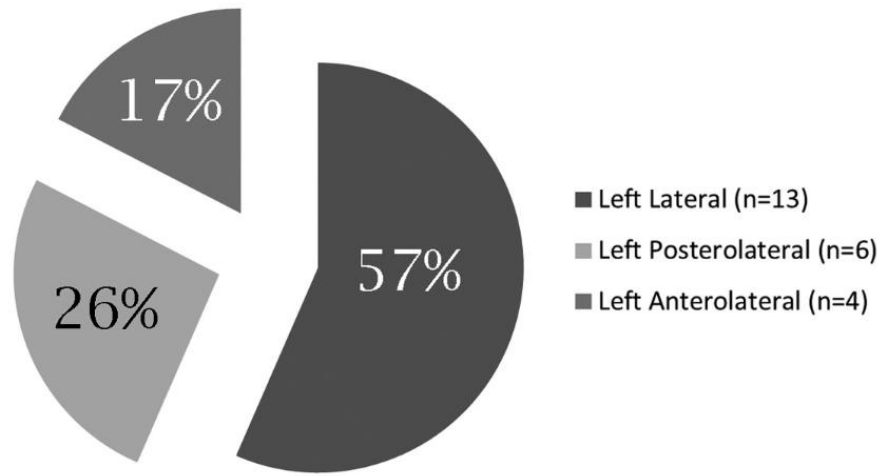
ELECTROPHYSIOLOGY

WILEY PACE

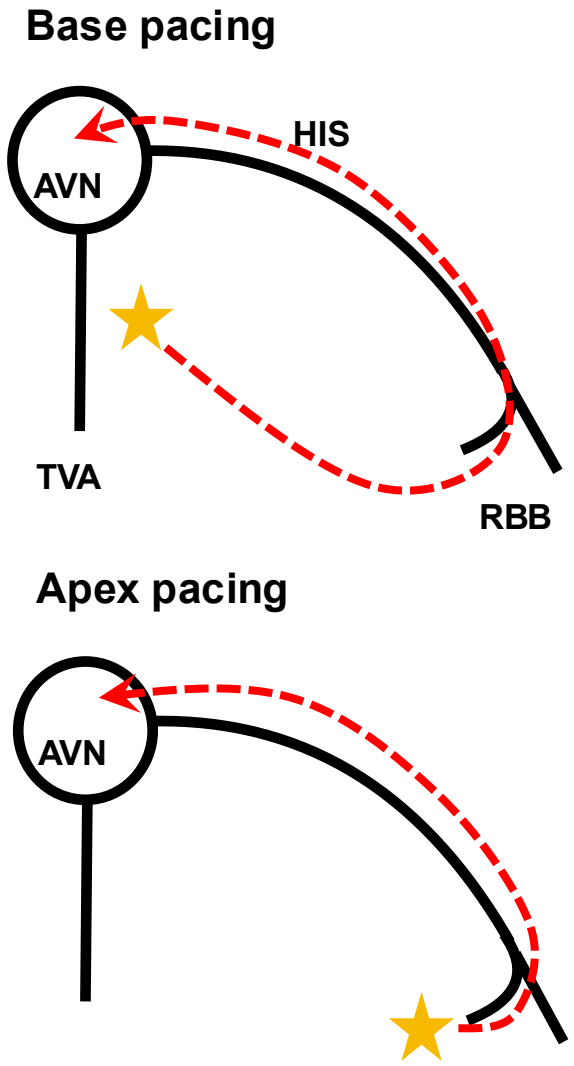
The "hidden" concealed left-sided accessory pathway: An uncommon cause of SVT in young people

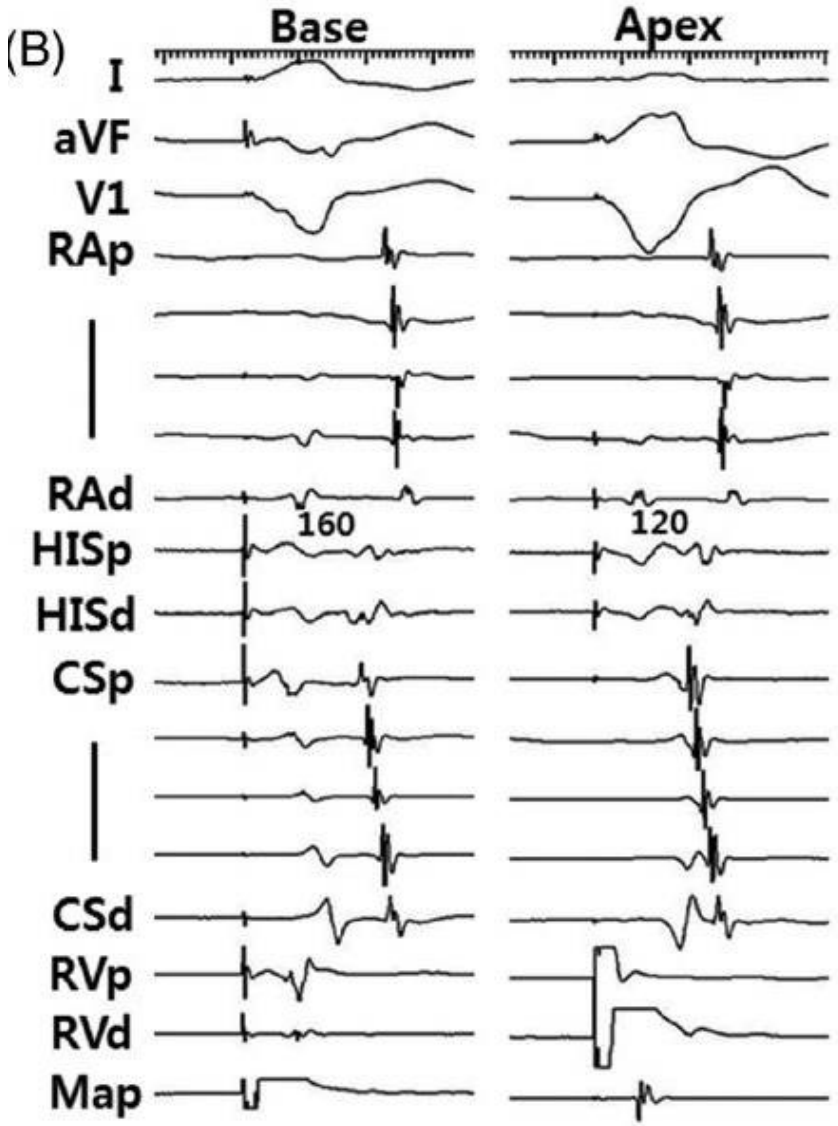
Results: A total of 23 patients met the criteria (median age, 14.3 years [range 7–21], weight, 51 kg [31–99]). 21 (96%) had SVT and one AFIB (4%). APs were adenosine sensitive in 7/20 patients (35%) and VA conduction was decremental in six (26%). CLAP conduction was demonstrable with orthodromic reentrant tachycardia in all patients, with RV extrastimulus testing in seven (30%) and with rapid RV pacing (<CL 300) in three (13%). Left ventricular (LV) pacing demonstrated CLAP conduction in 17/17 (100%) patients in whom it was used. All 23 CLAPs were successfully ablated (100%) via transseptal approach with radiofrequency energy. Specific ablation techniques included: 16 (70%) during LV paced rhythm, four (17%) during orthodromic reciprocating tachycardia (ORT; 3/4 ventricular entrained), and three (13%) with brief rapid RV pacing. There were no complications. At 18 months (range 3–96), there was one recurrence (4%).

Conclusions: Some CLAPs are only demonstrable with LV pacing, entrained ORT, or rapid RV pacing. LV pacing facilitated preferential AP conduction, allowing for mapping while maintaining stable hemodynamics.

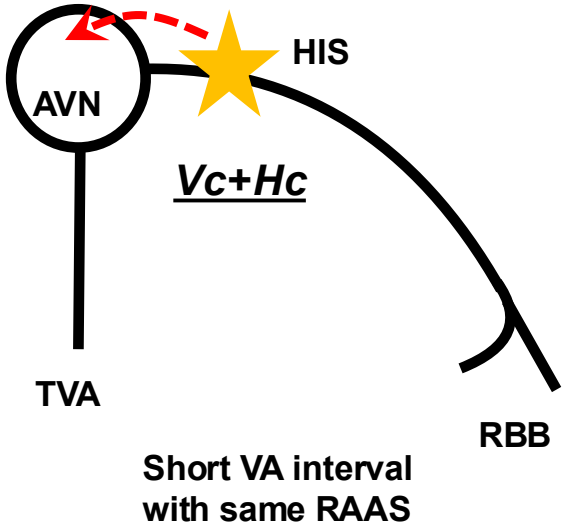


Differential Base vs. Apex pacing

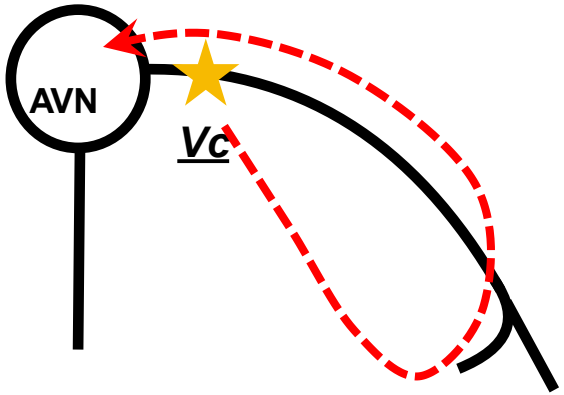




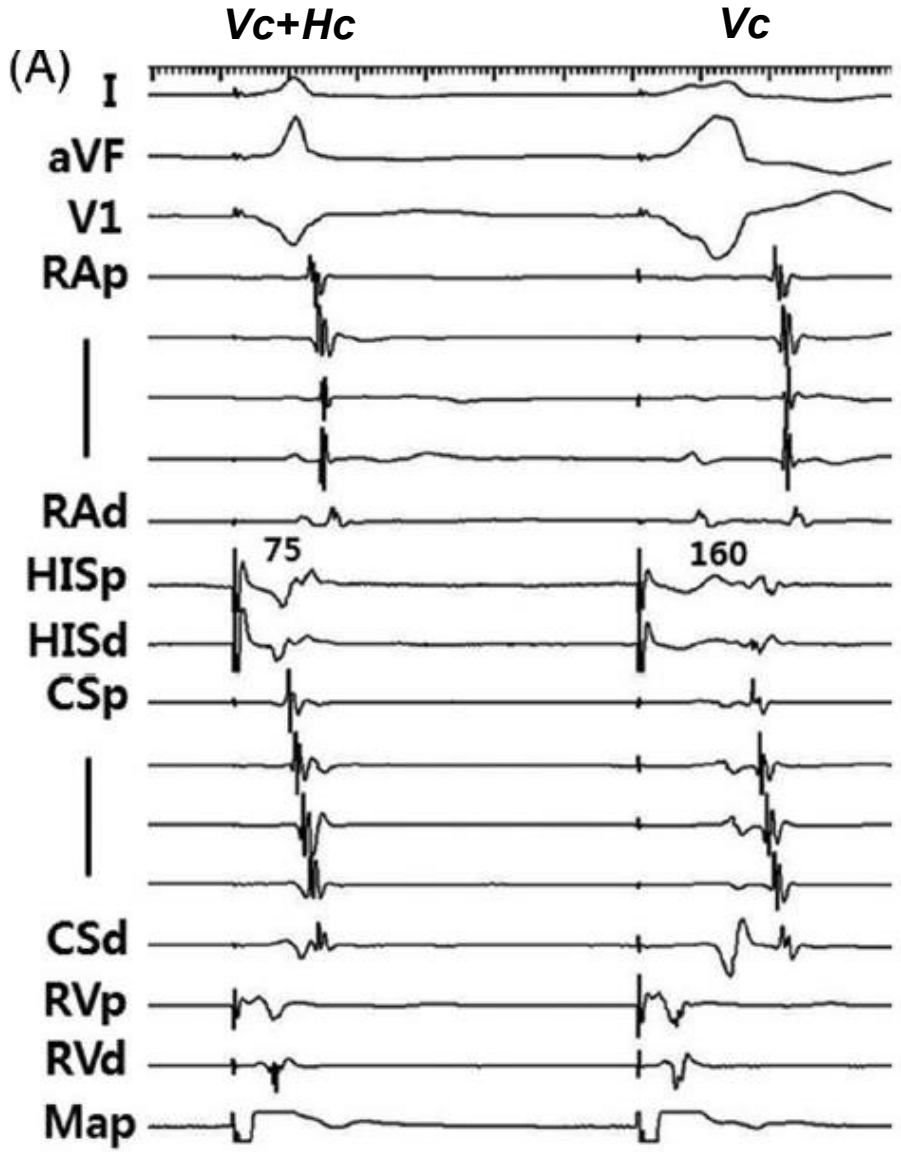
Para-Hisian pacing(Nodal response)



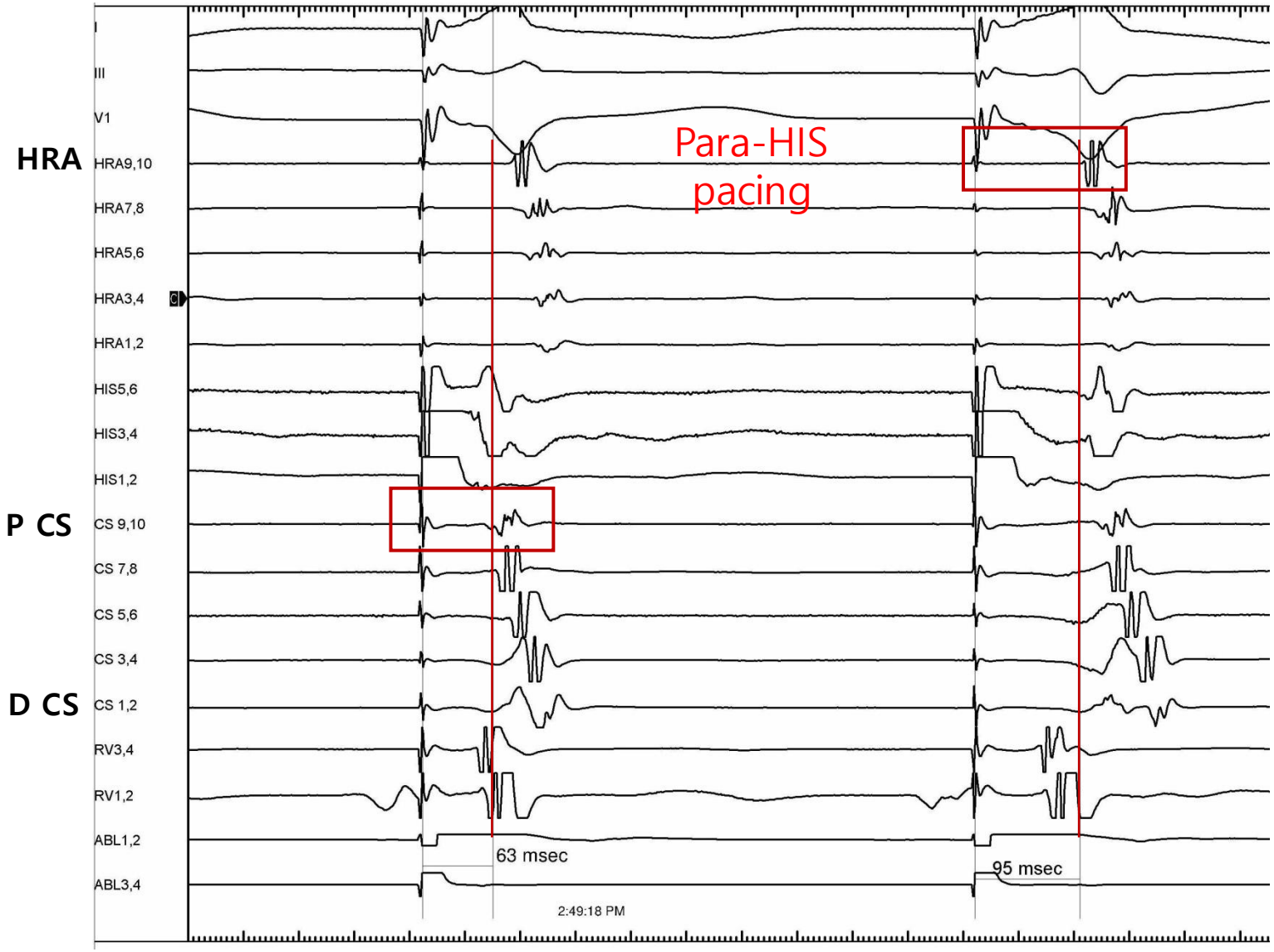
Short VA interval
with same RAAS



Longer VA interval
with same RAAS

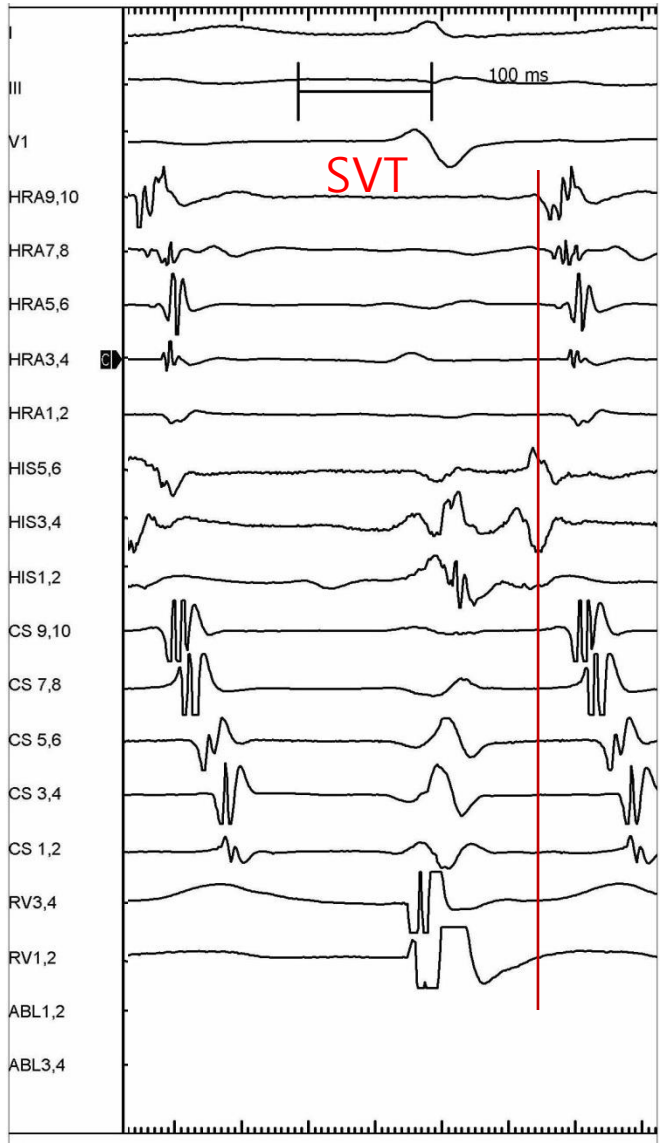


Nodal responses?

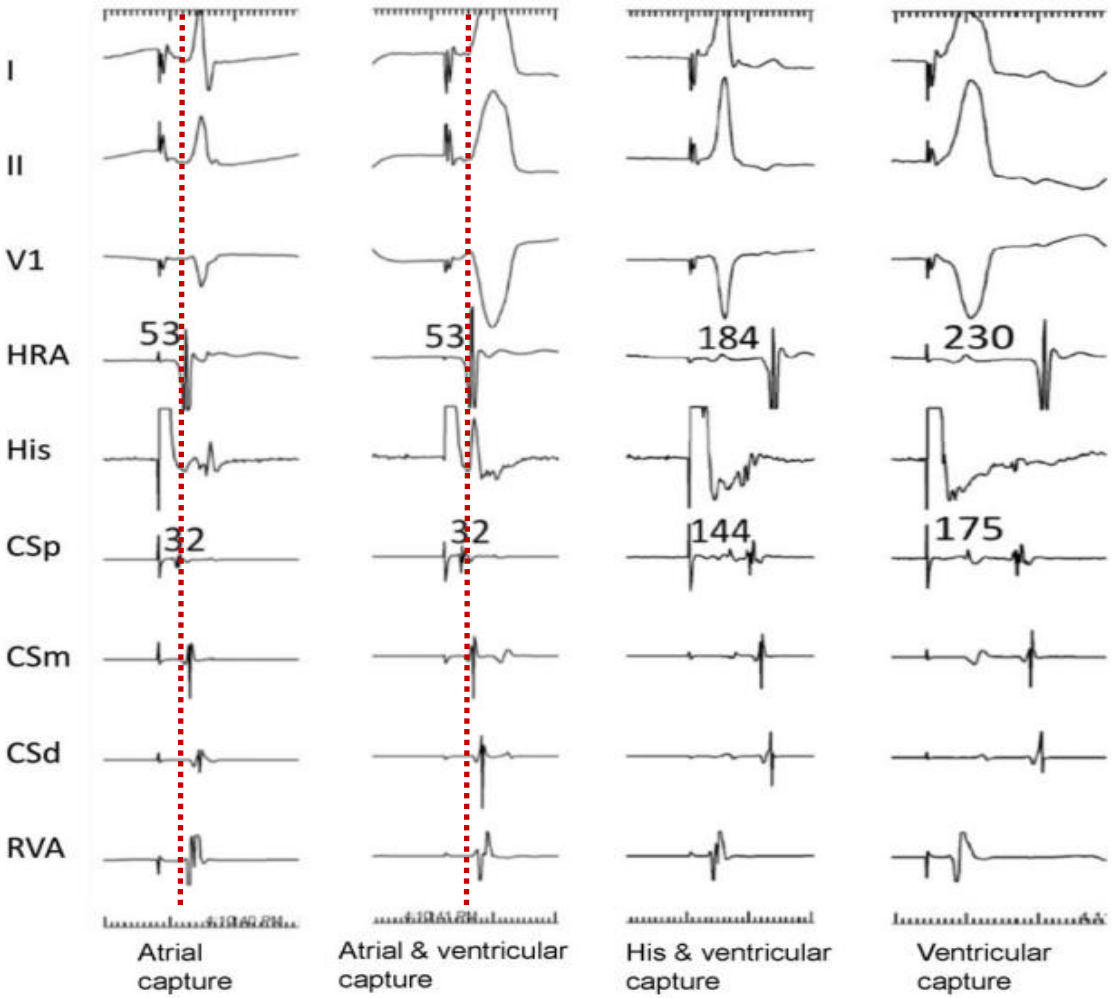


AVN conduction

AP conduction



Inadvertent atrial capture



SA interval from pCS < 50ms might indicate direct atrial capture

Obeyesekere et al

Ventricular entrainment

■ Initiation

- Transition Zone

■ Middle

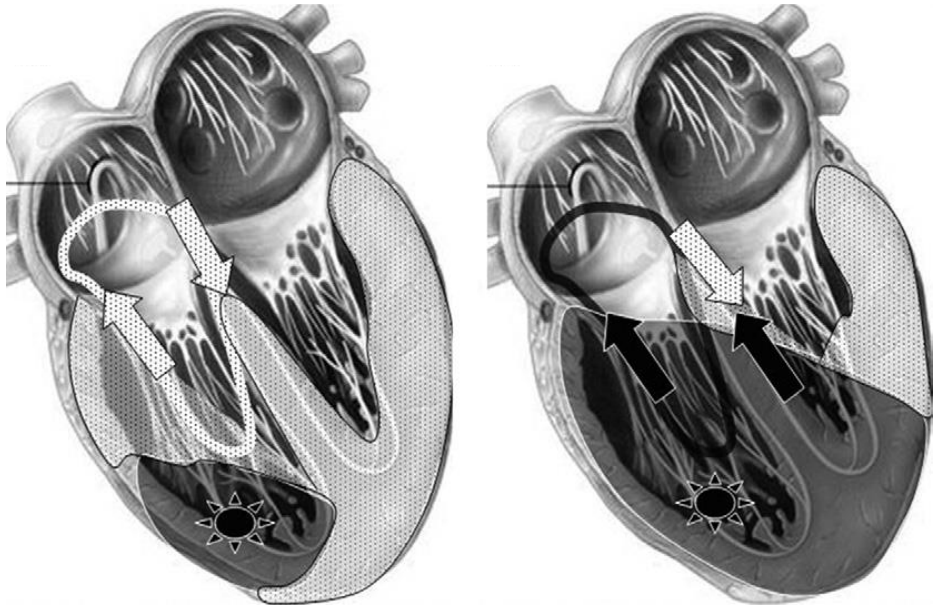
- Ventricular fusion
- VA linking

■ Post

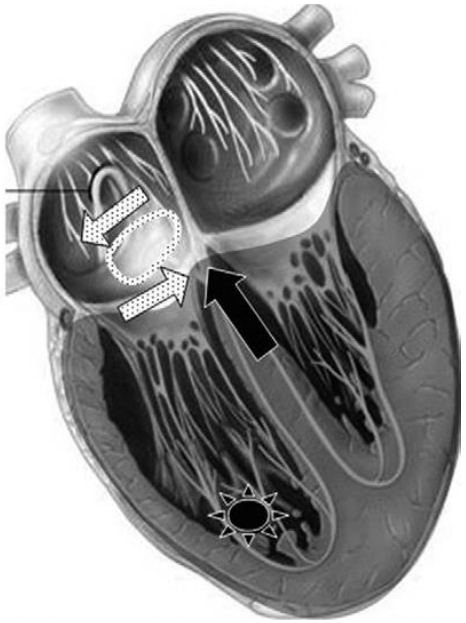
- Antegrade vs. retrograde His capture
- V-A-V or V-A-A-V response
- Measurement : PPI-TCL, delta VA interval

Transition Zone(TZ)

AVRT



AVNRT

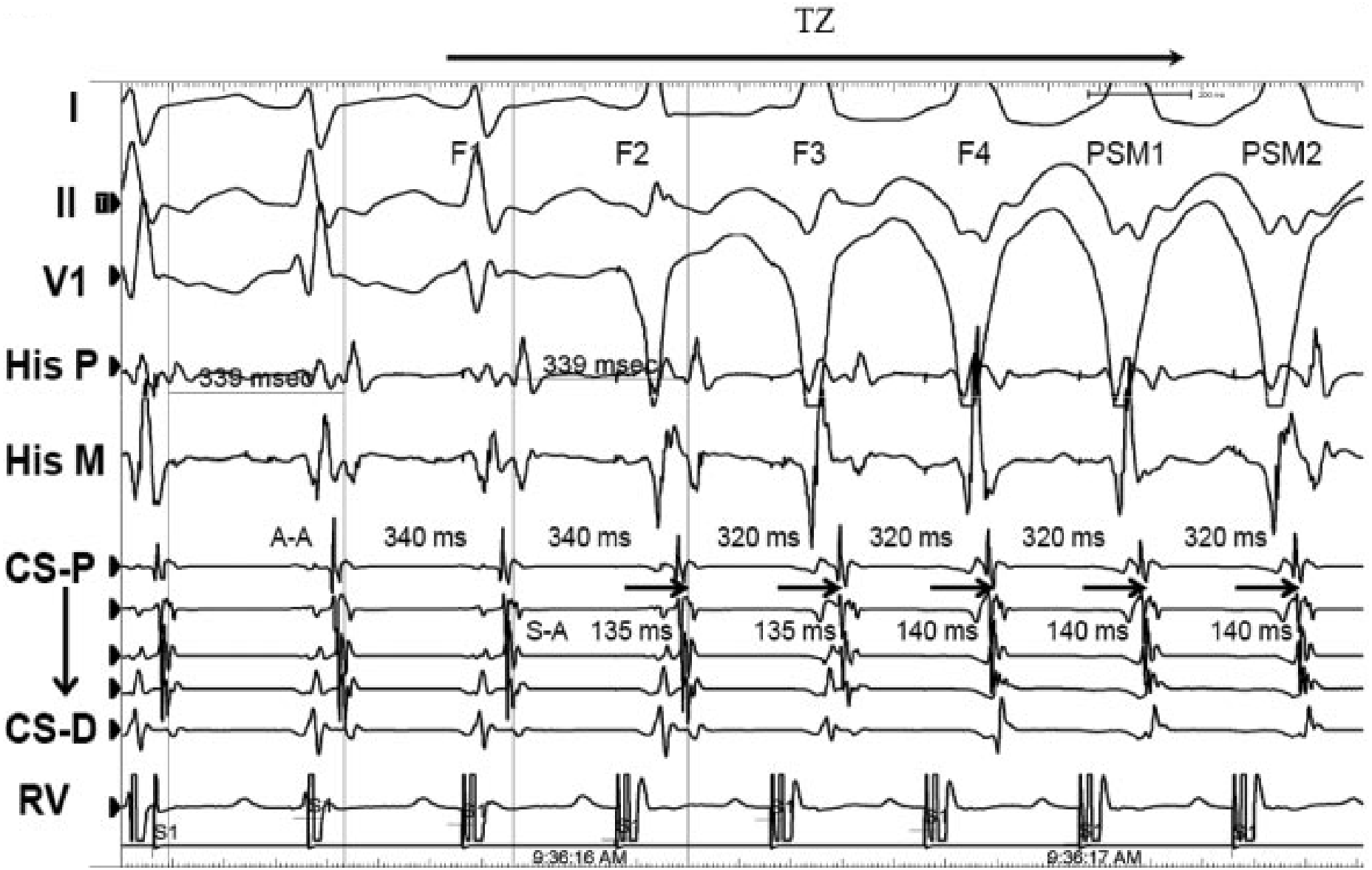


1st pacing ⟷ ***Transition Zone*** ⟷ Stable QRS

Resetting before stable QRS

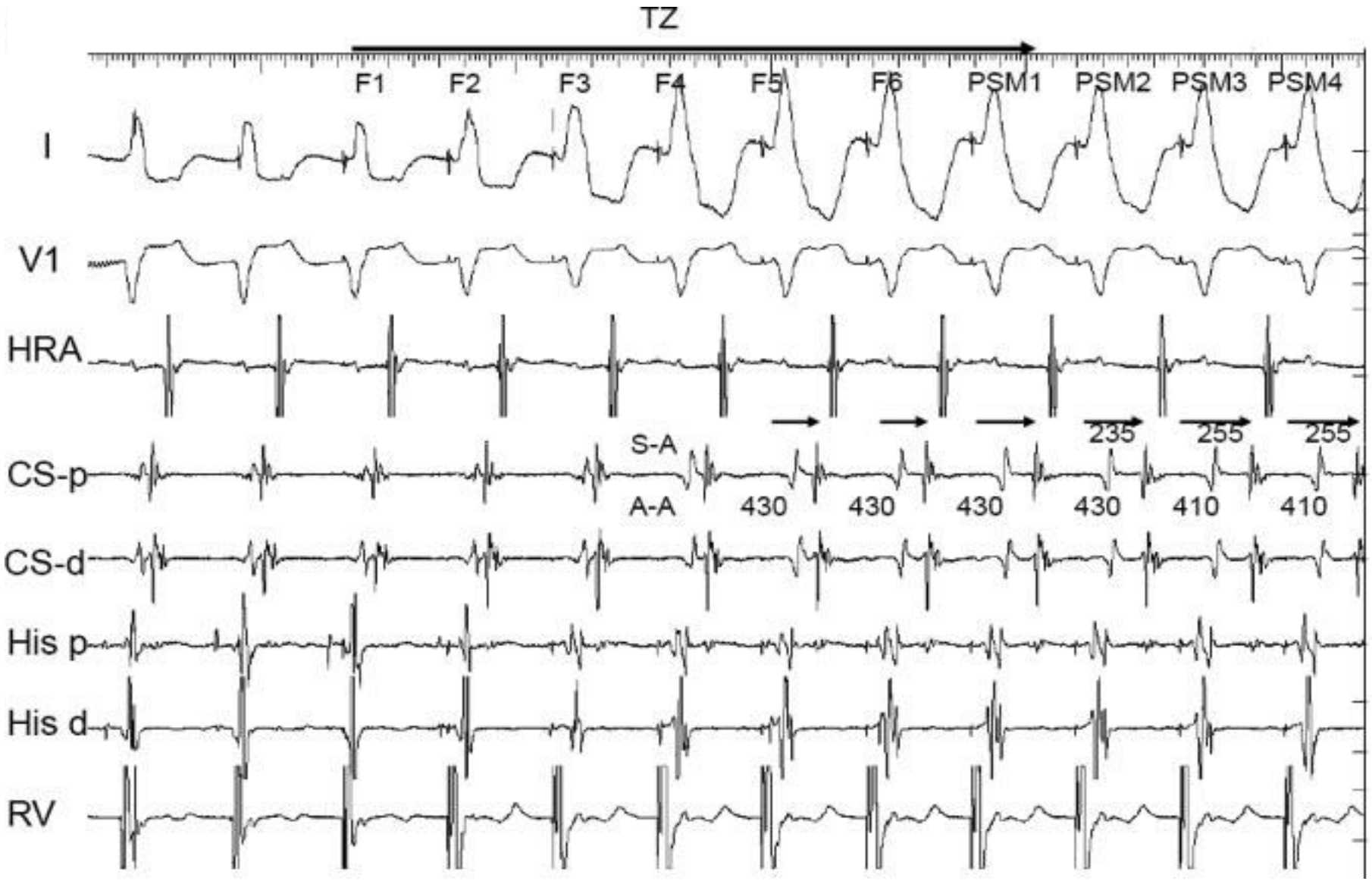
Resetting after stable QRS

Rosman et al



AVRT : Restting – within TZ

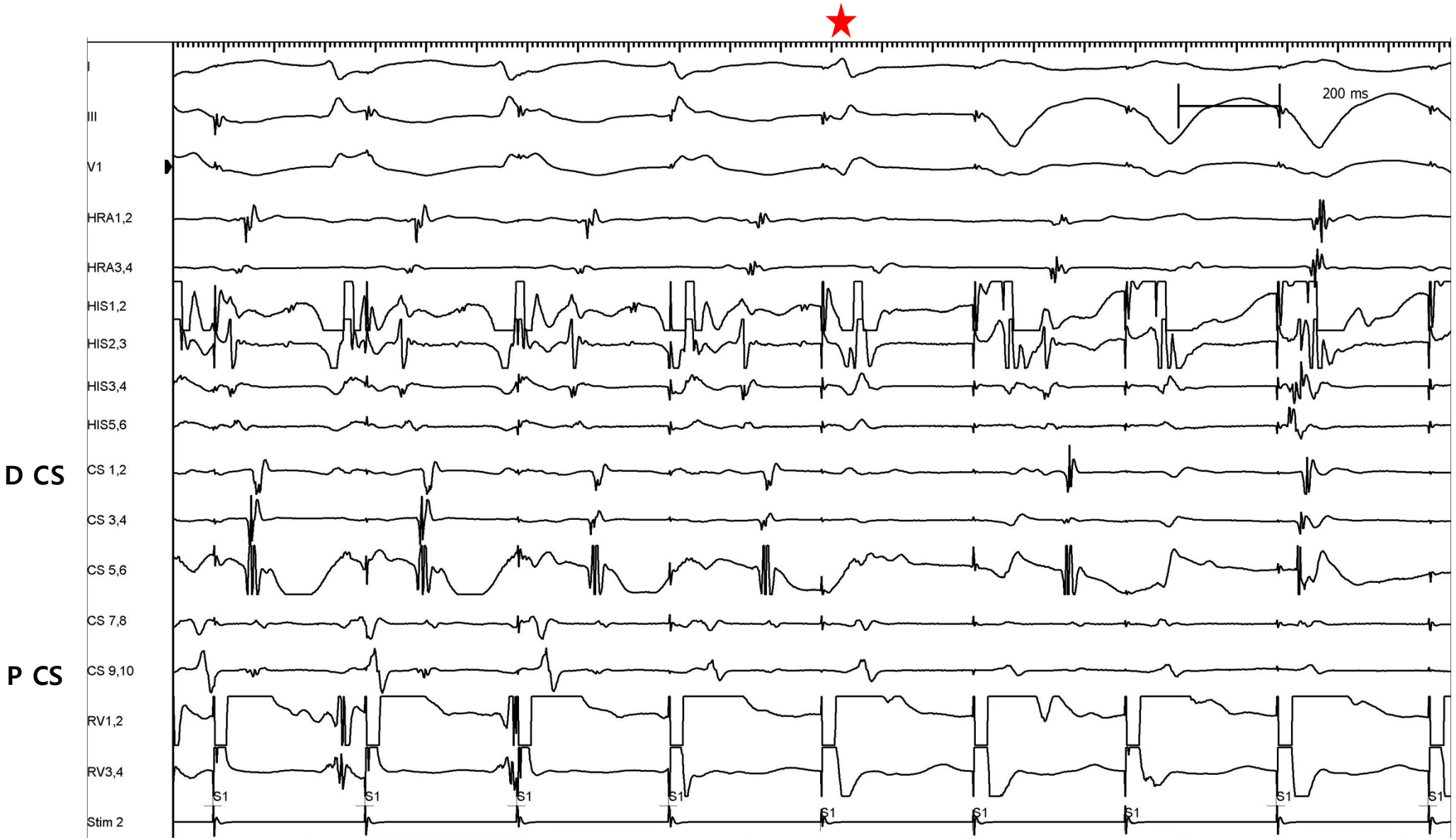
AlMahameed et al



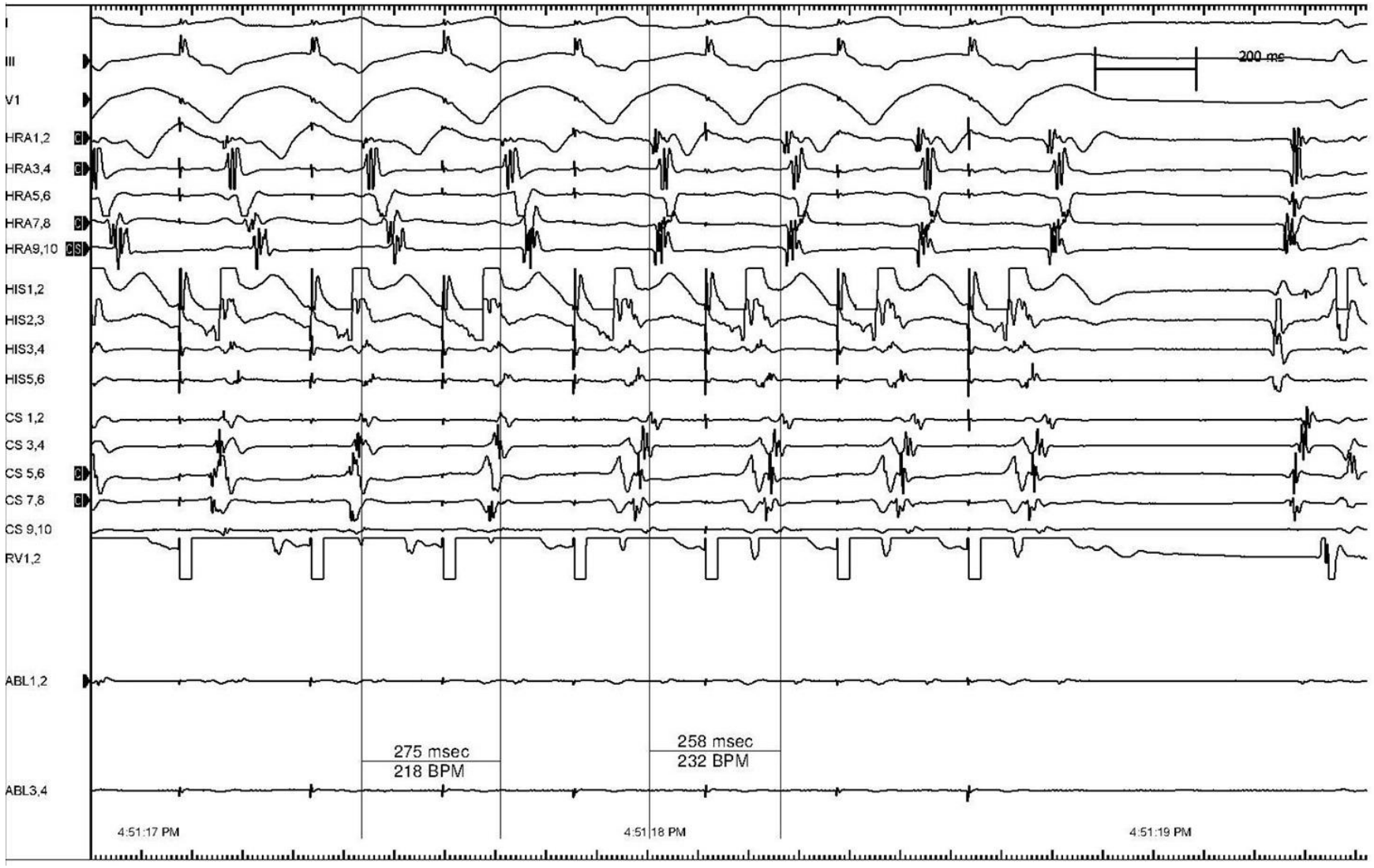
AVNRT : Restting – after TZ

AlMahameed et al

Diagnosis?


I
III
V1
HRA1,2
HRA3,4
HIS1,2
HIS2,3
HIS3,4
HIS5,6
D CS
CS 1,2
CS 3,4
CS 5,6
CS 7,8
P CS
CS 9,10
RV1,2
RV3,4
Stim 2
200 ms
S1

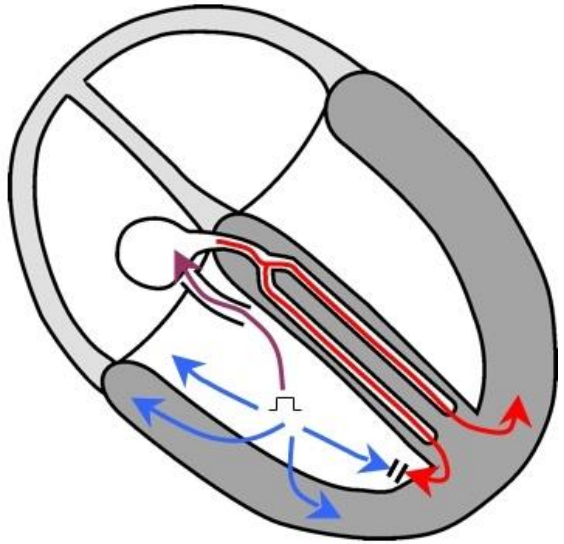
Diagnosis?



D CS

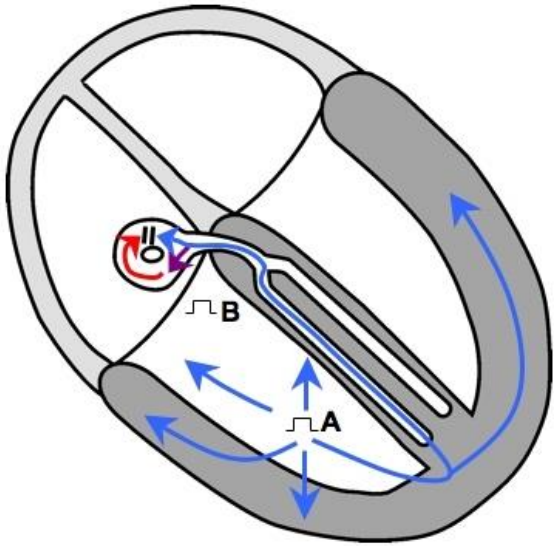
P CS

Achievement of QRS fusion during ventricular entrainment



AVRT

QRS complex fusion

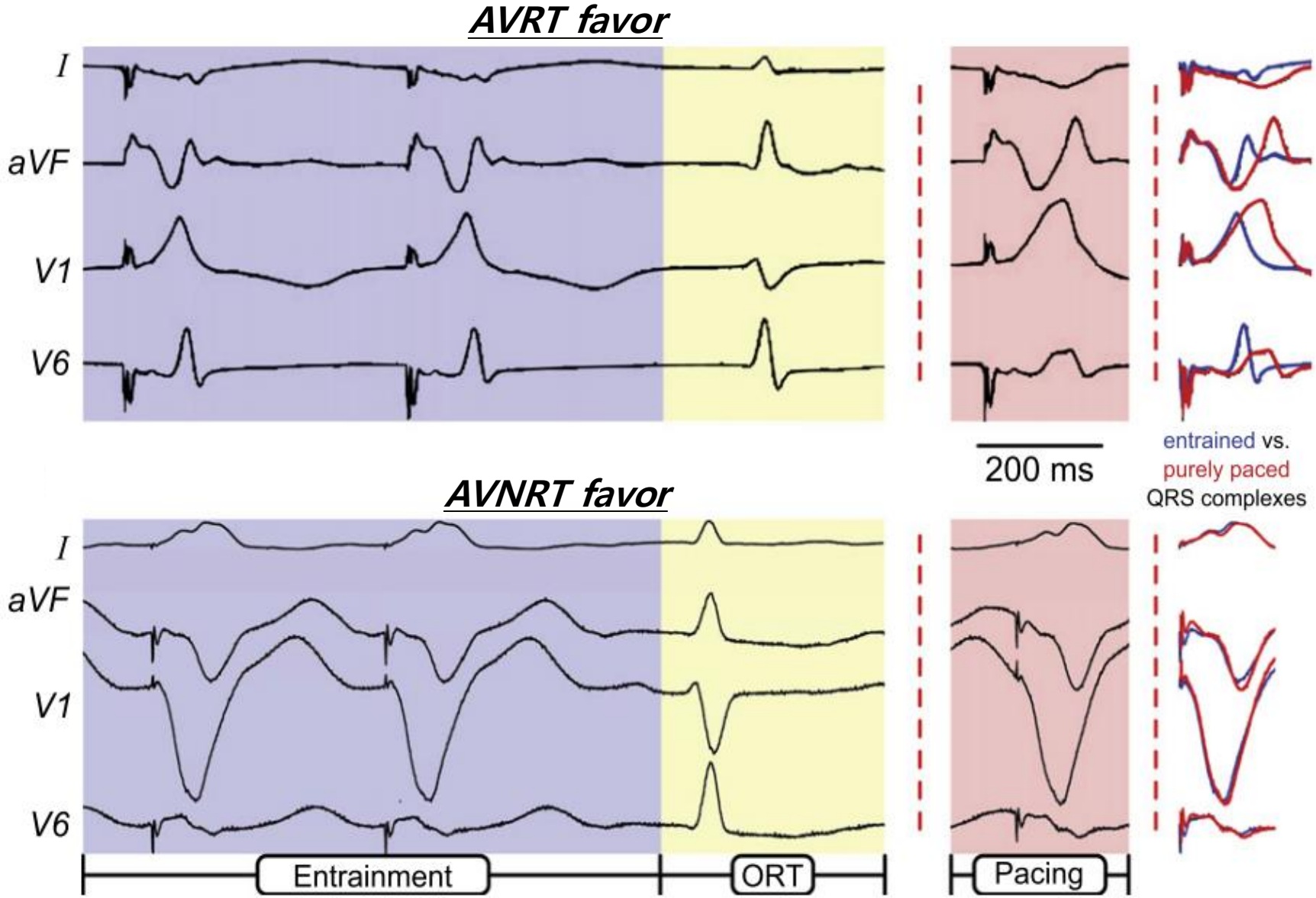


AVNRT

Fully Paced beat

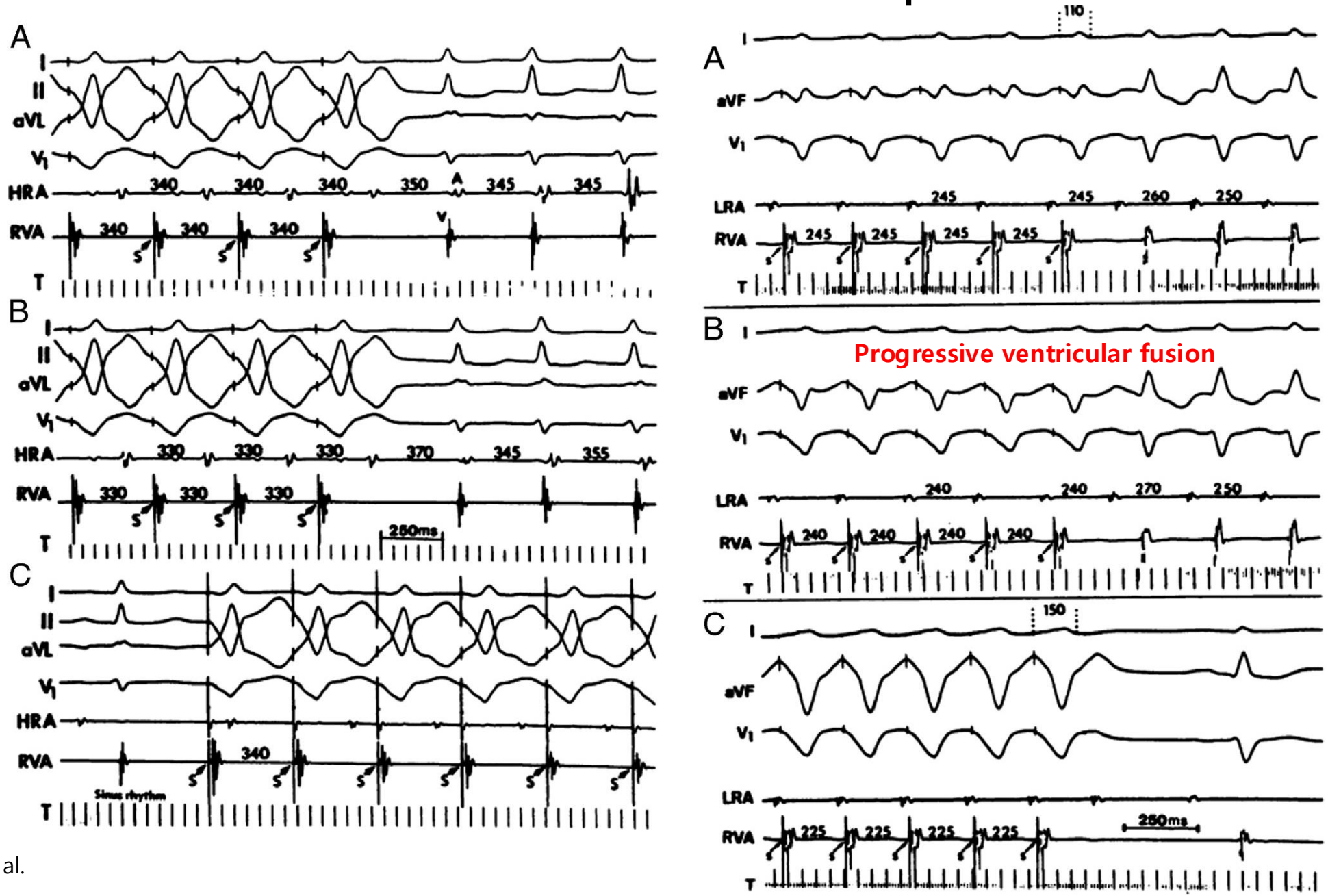
Constant QRS fusion during ventricular entrainment suggest AVRT

Rosman et al


AVRT favor
I
aVF
V1
V6
200 ms
entrained vs.
purely paced
QRS complexes
AVNRT favor
I
aVF
V1
V6
Entrainment
ORT
Pacing

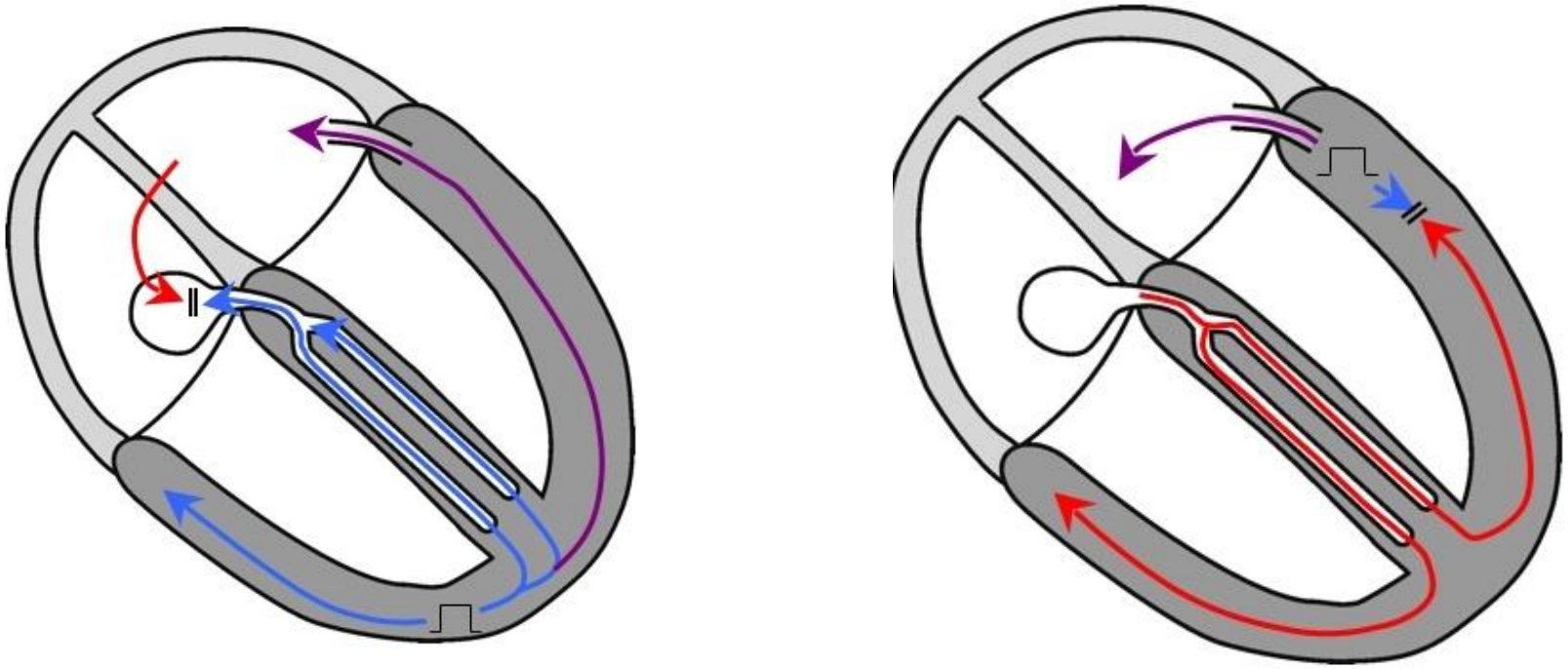
Boyle et al

Ventricular fusion: PCL dependence



Ormaetxe et al.

Ventricular fusion: Pacing site dependence



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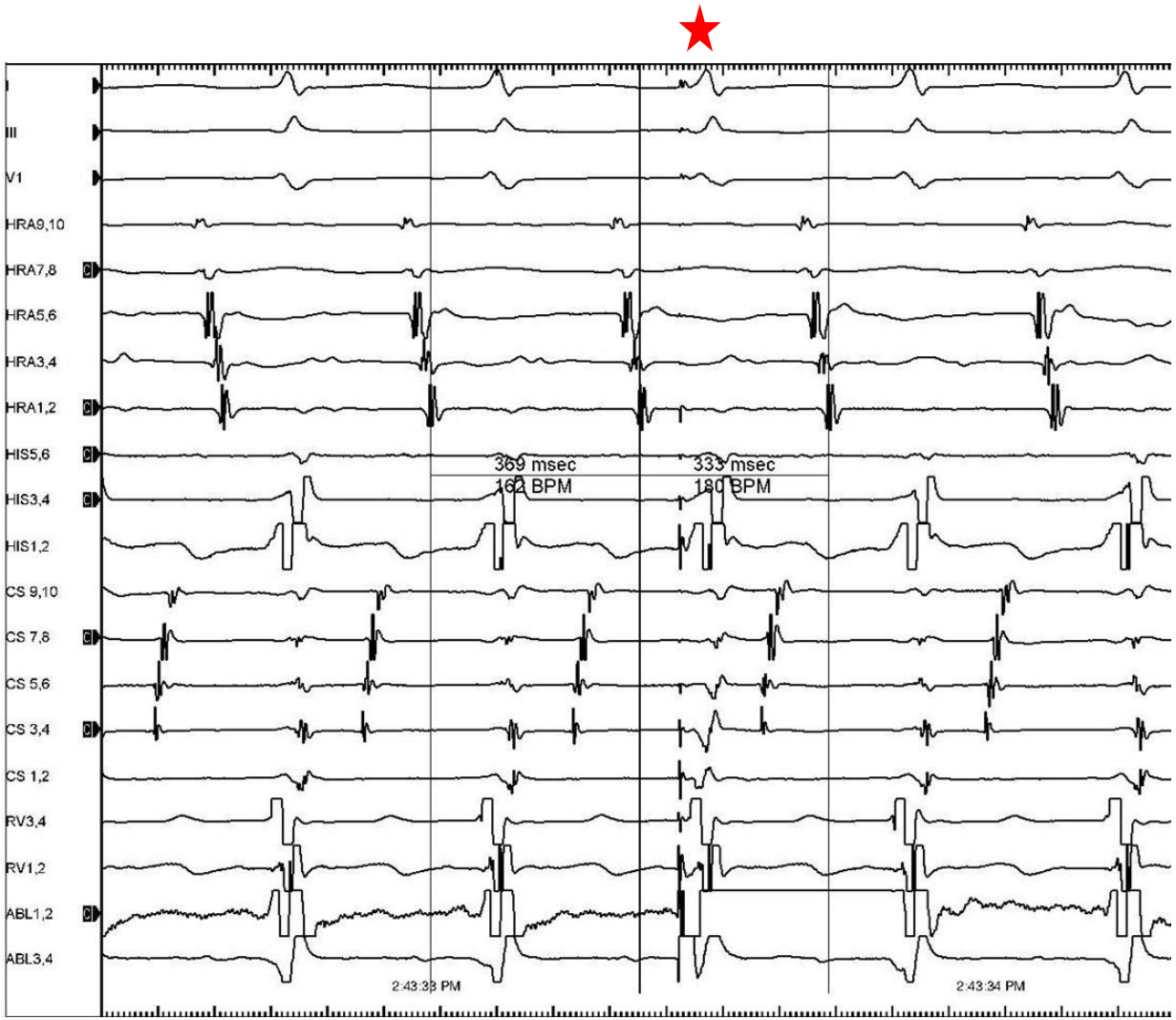
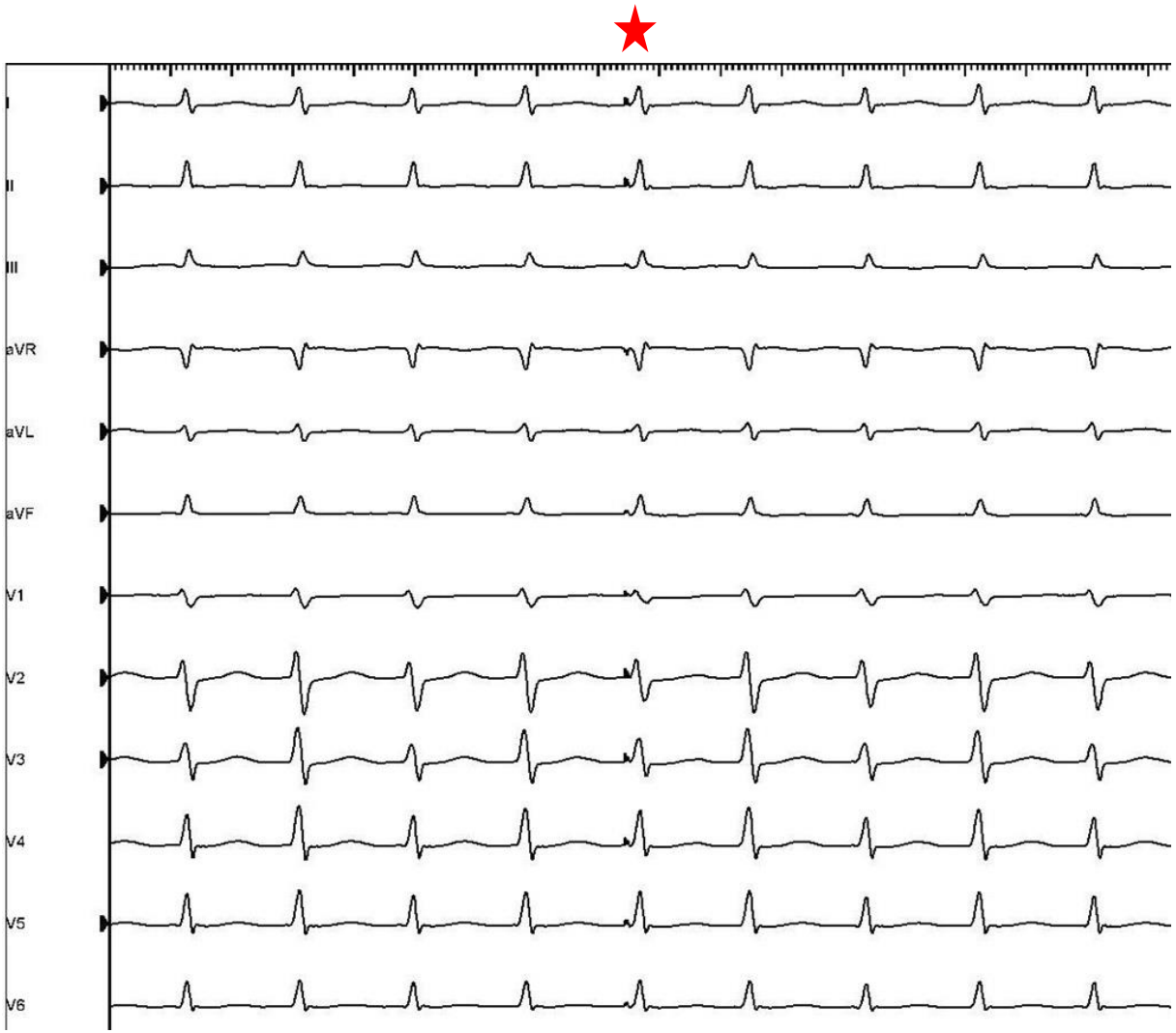
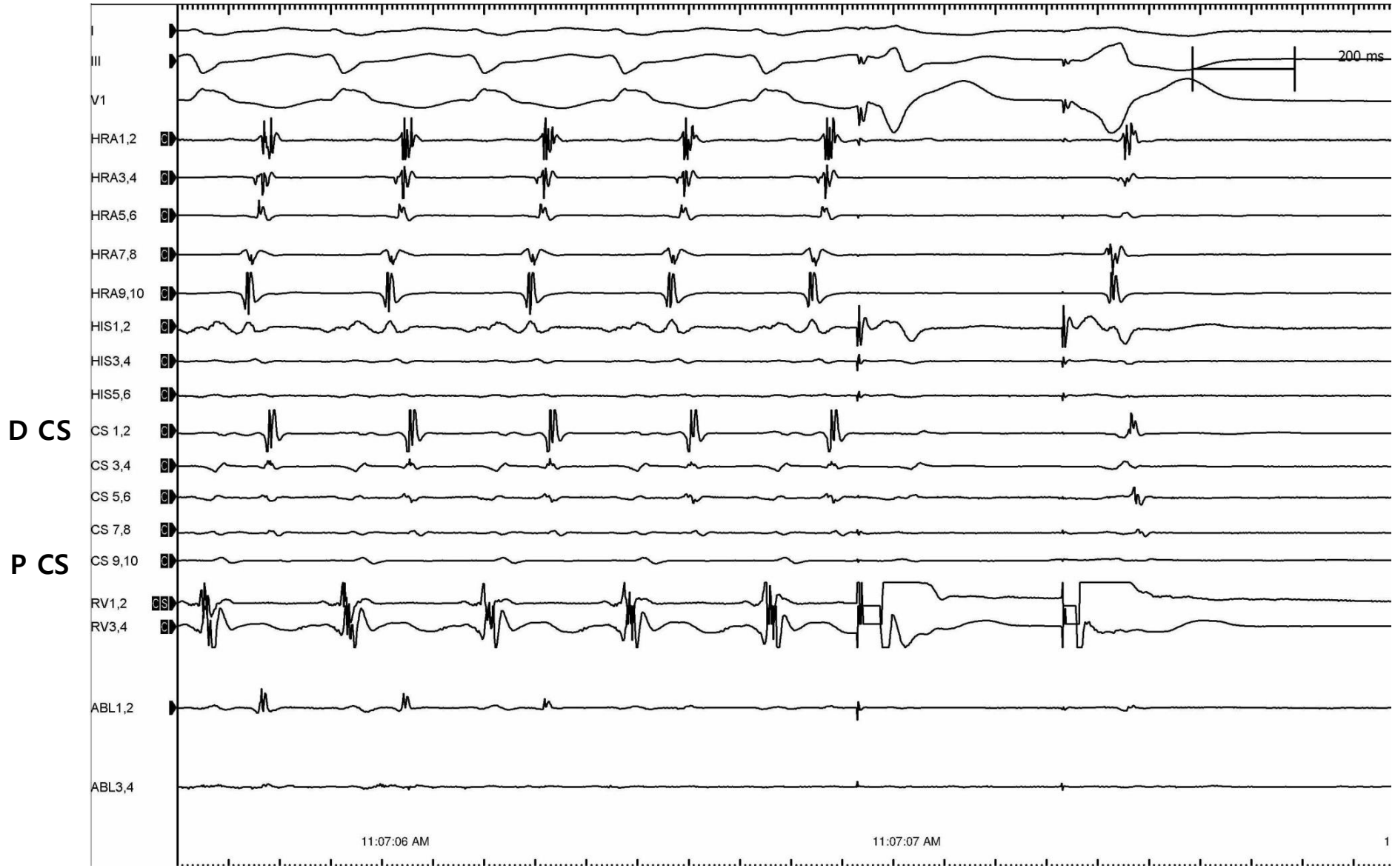
To increase degree of fusion pacing should be performed as close as possible to the reentrant circuit near the AP

Delivery of LV PVC in AVRT using left lateral pathway



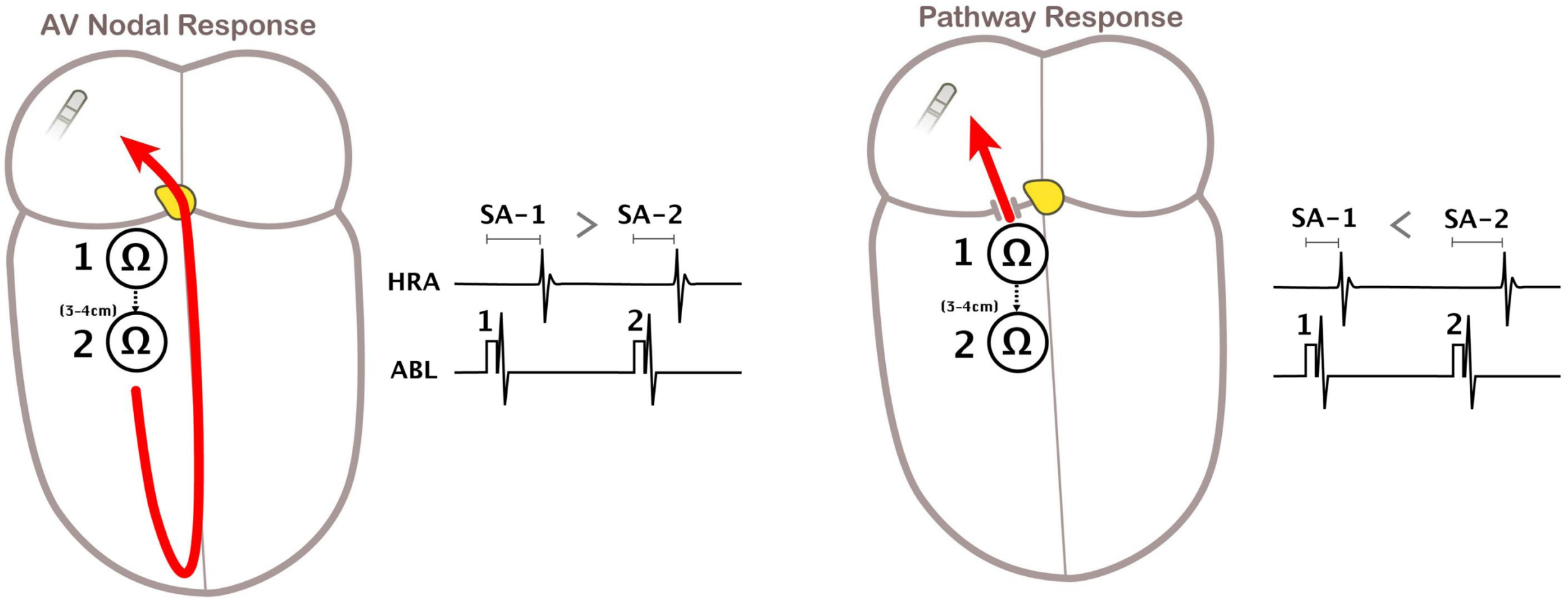


Termination of tachycardia with fused PVC



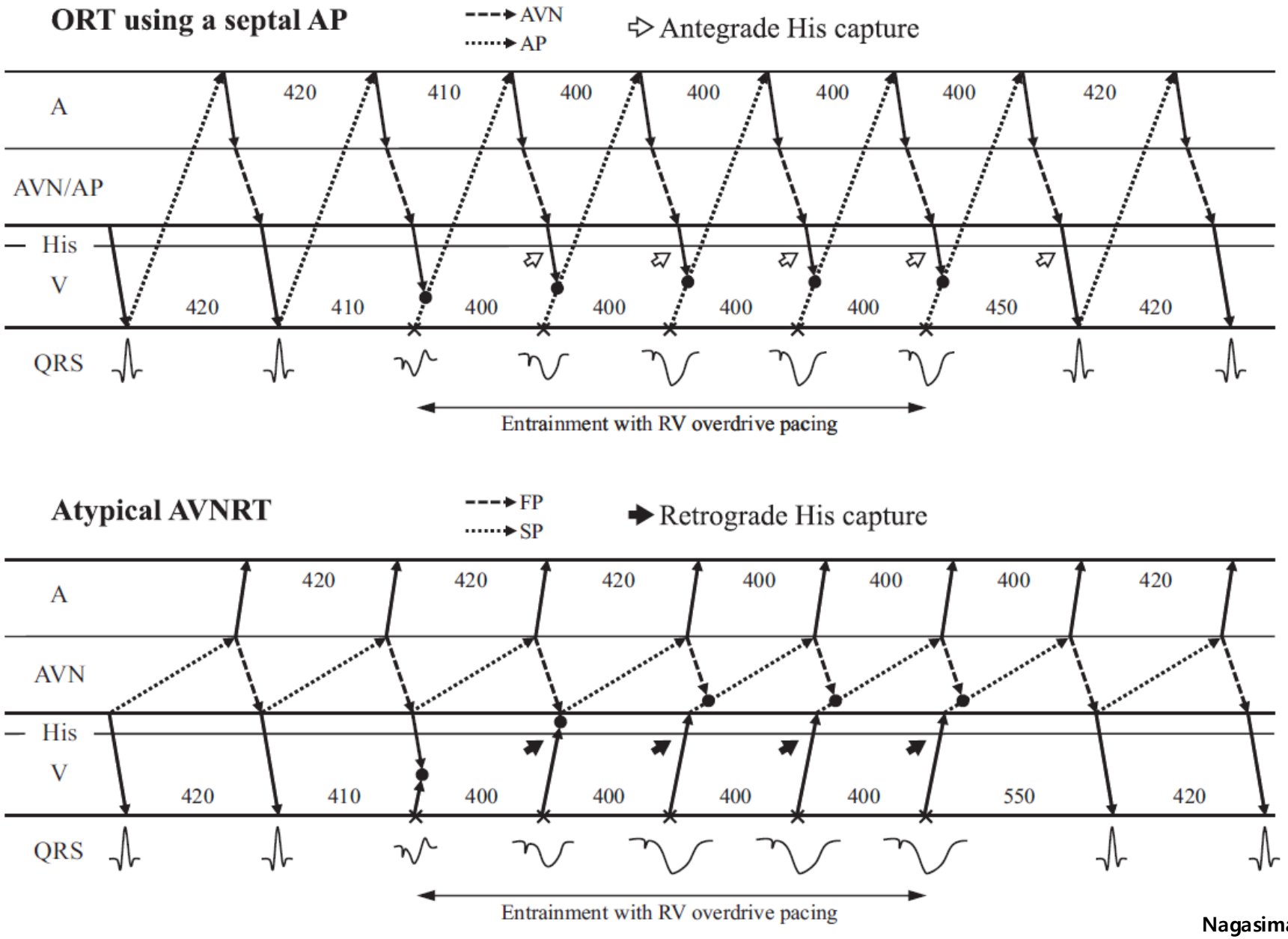
Differential ventricular entrainment

If cut-off values are border line



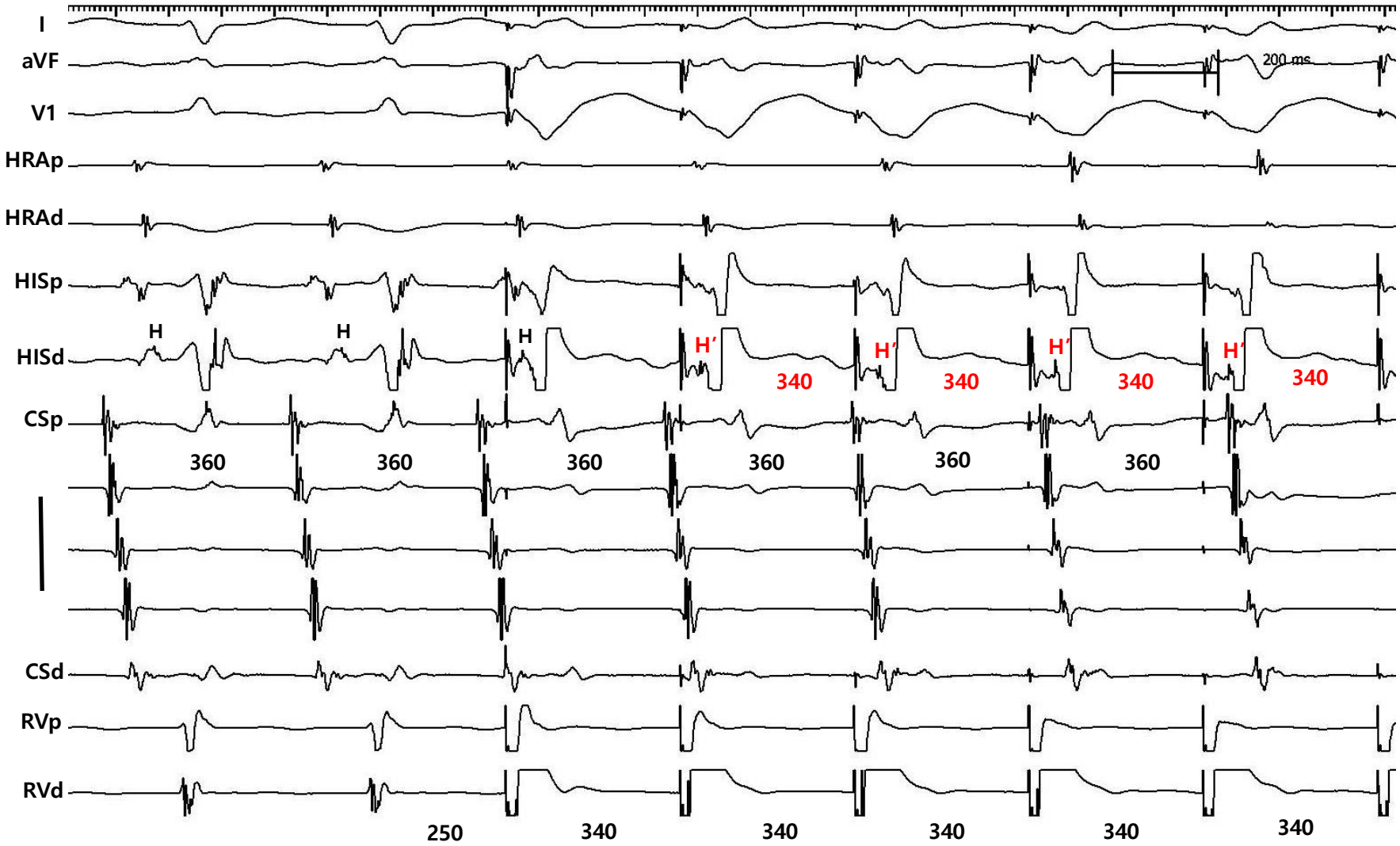
J. Cardiovasc. Electrophysiol. 2024;35:2246–2247.

Antegrade vs. Retrograde His capture

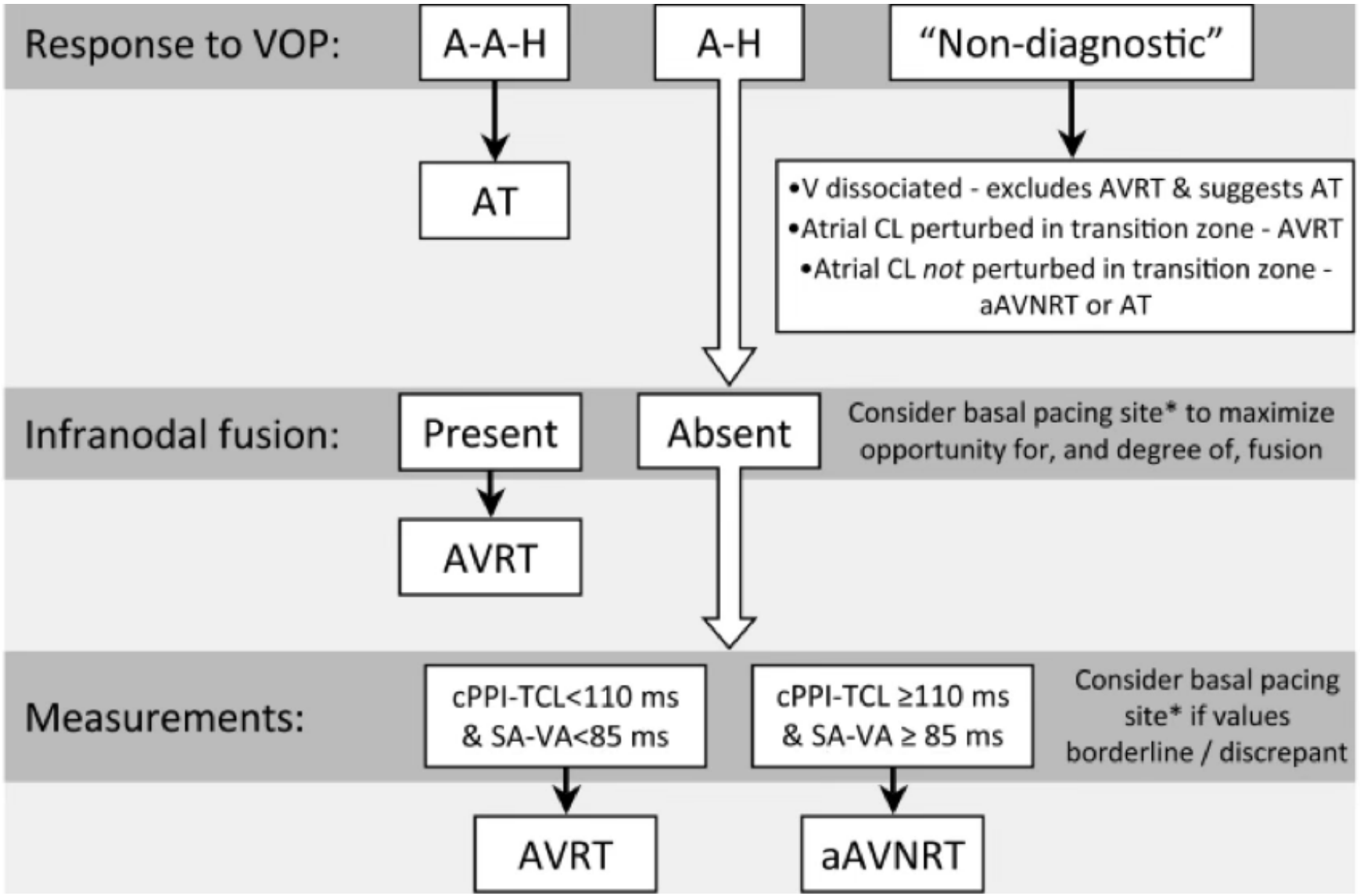


Nagasima et al

Initiation of RV entrainment



Dissociation of the HIS bundle activation from the tachycardia

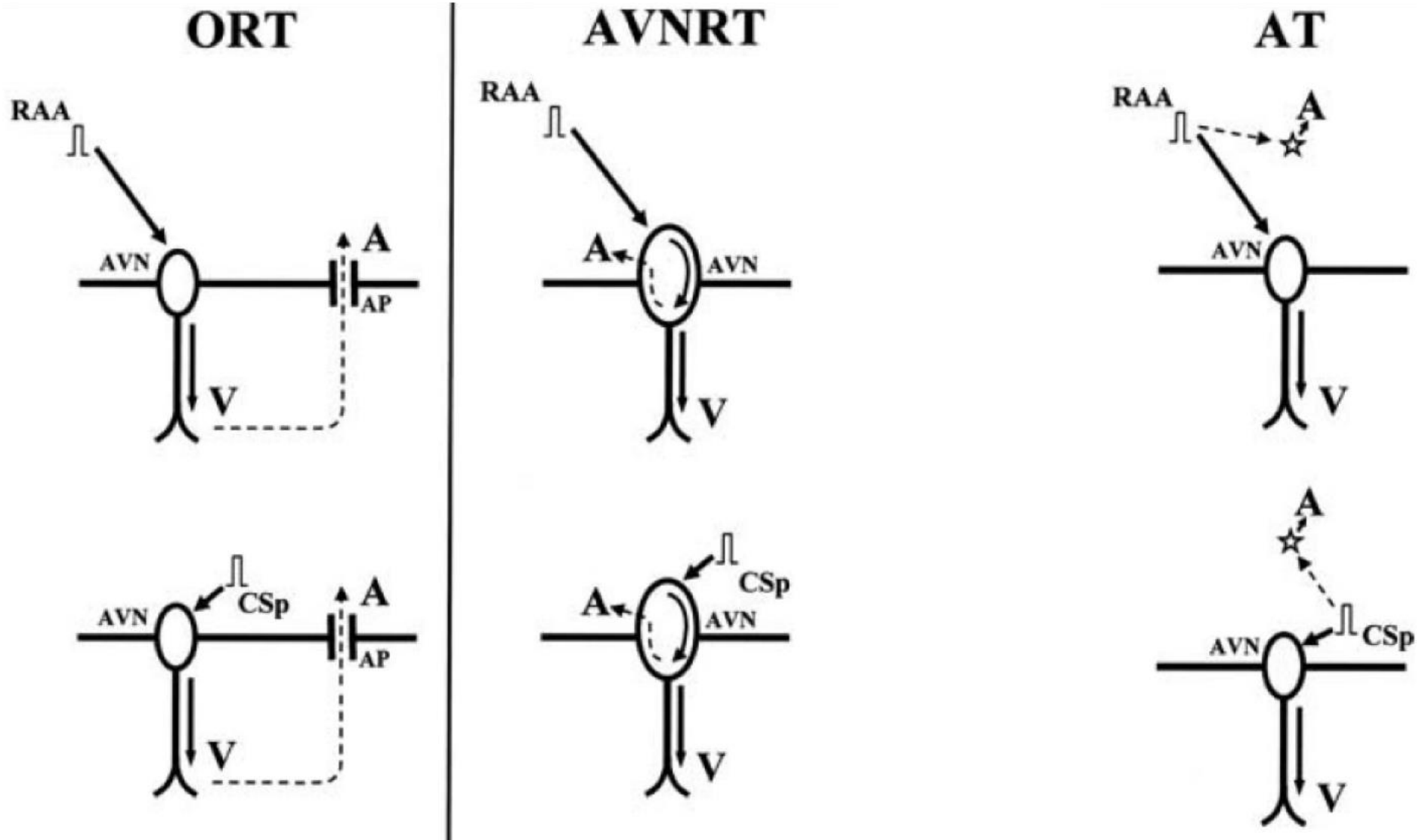


VEENHUYZEN, ET AL.

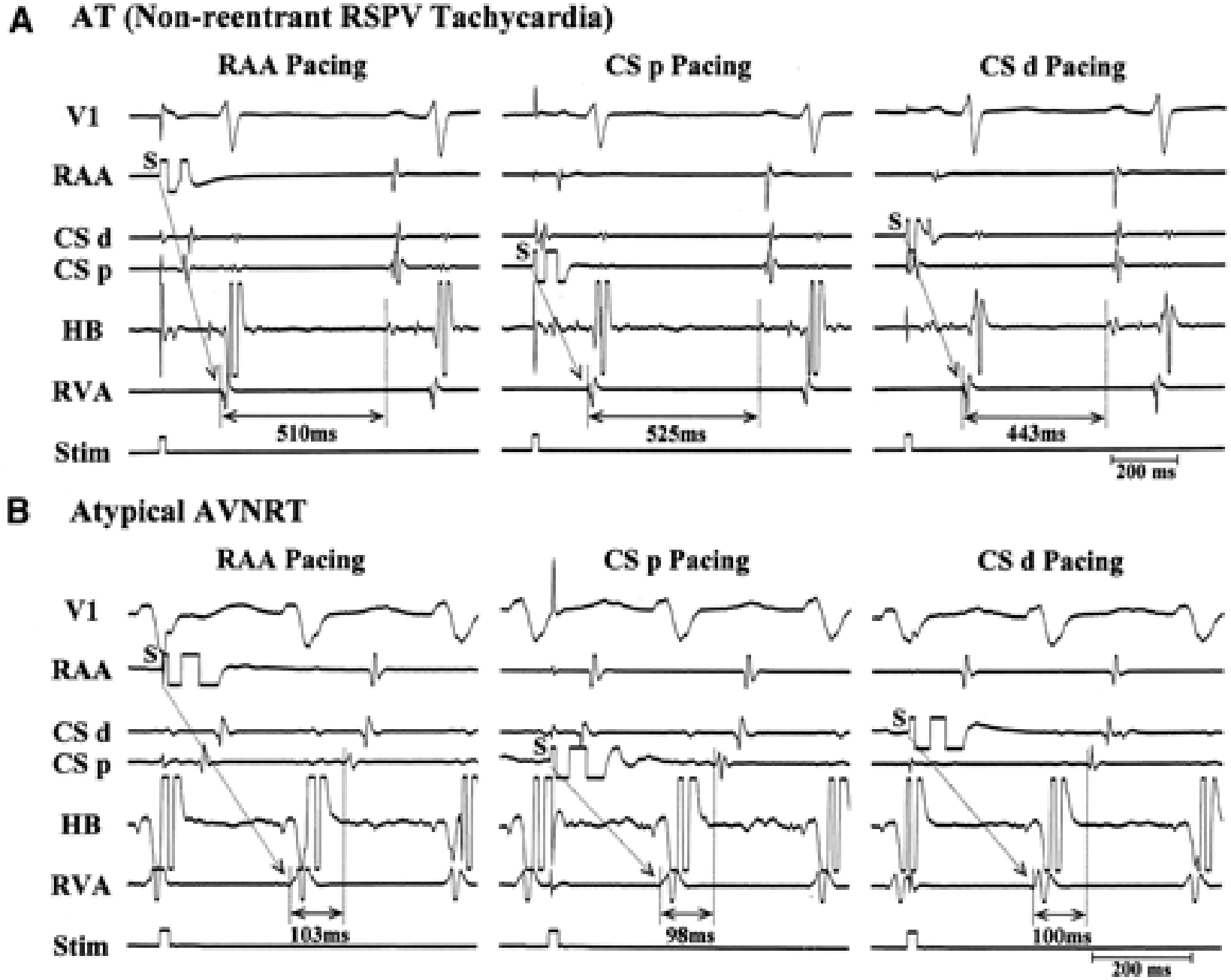
VA linking: multi-site atrial overdrive pacing

VA linking: Fixed VA interval

Variable VA interval



J Cardiovasc Electrophysiol, Vol. 18, pp. 1127-1133,



Cut off : 14ms

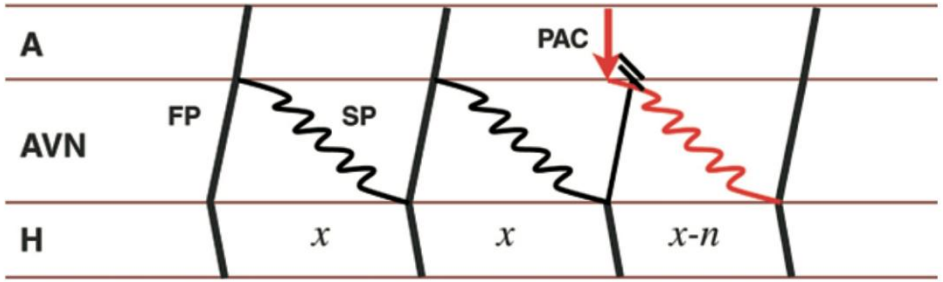
J Cardiovasc Electrophysiol, Vol. 18, pp. 1127-1133,

Delivery of PAC : AVNRT vs. JT

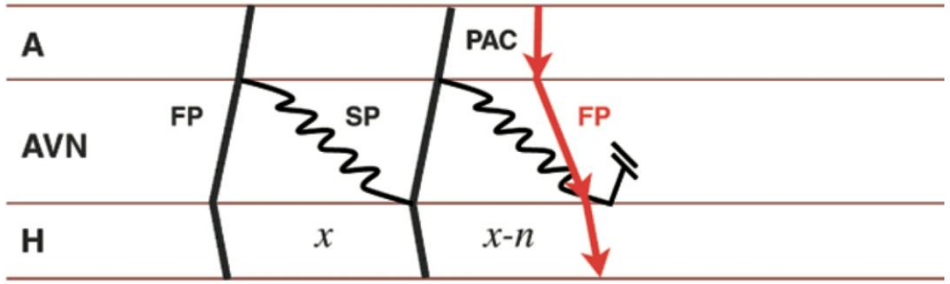
Late PAC
HIS refractory

Early PAC

AVNRT

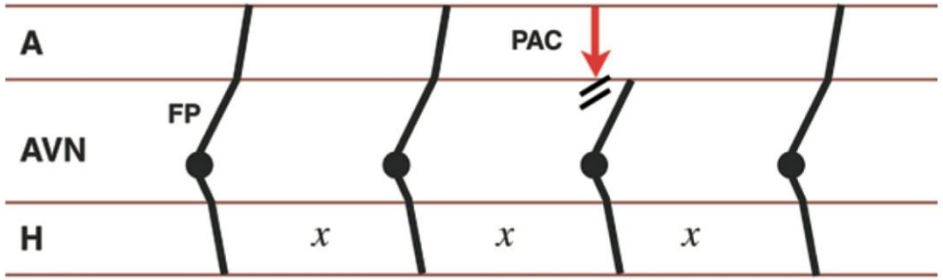


Reset

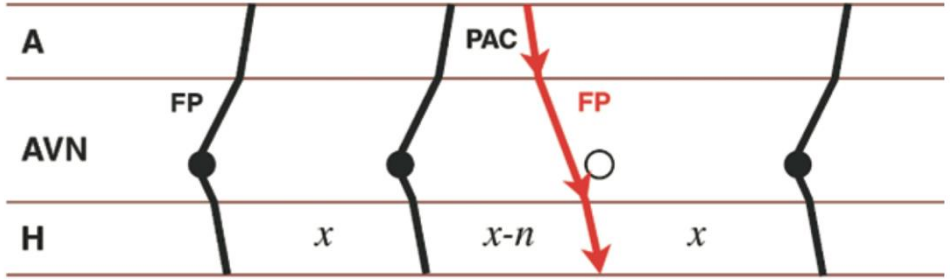


Termination

JT



No reset



Reset

Late PAC advanced next His activation

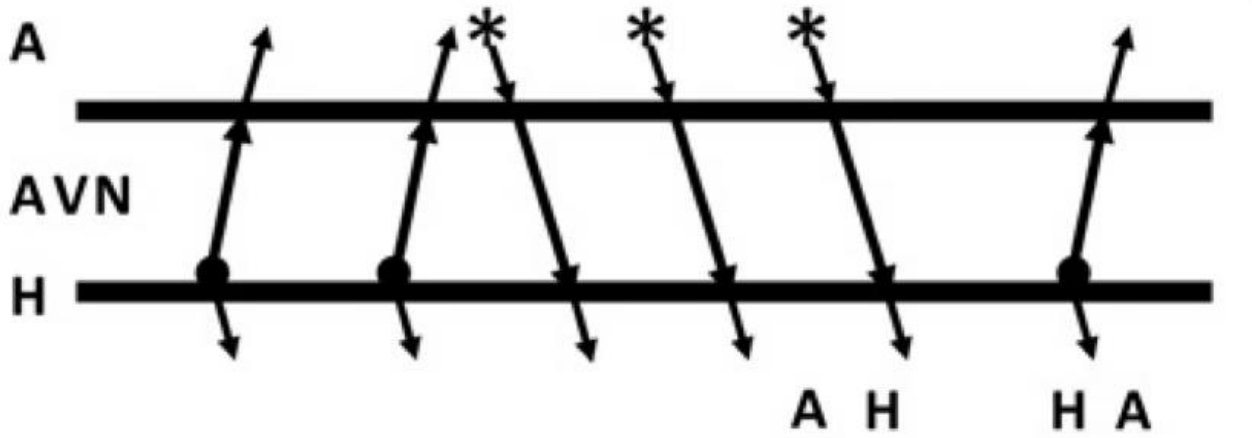
Early PAC terminated tachycardia

P CS

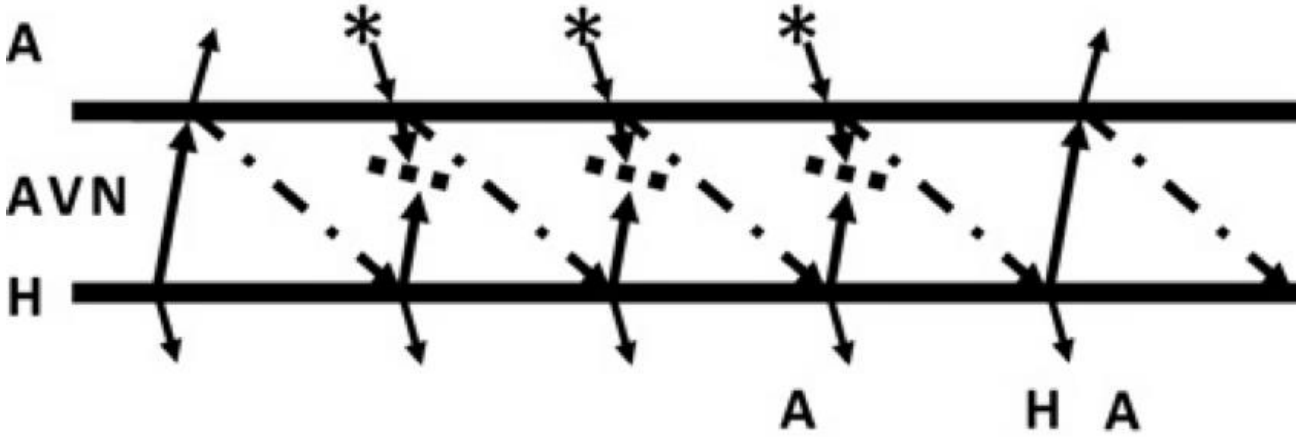
D CS

AOP: AVNRT vs. JT

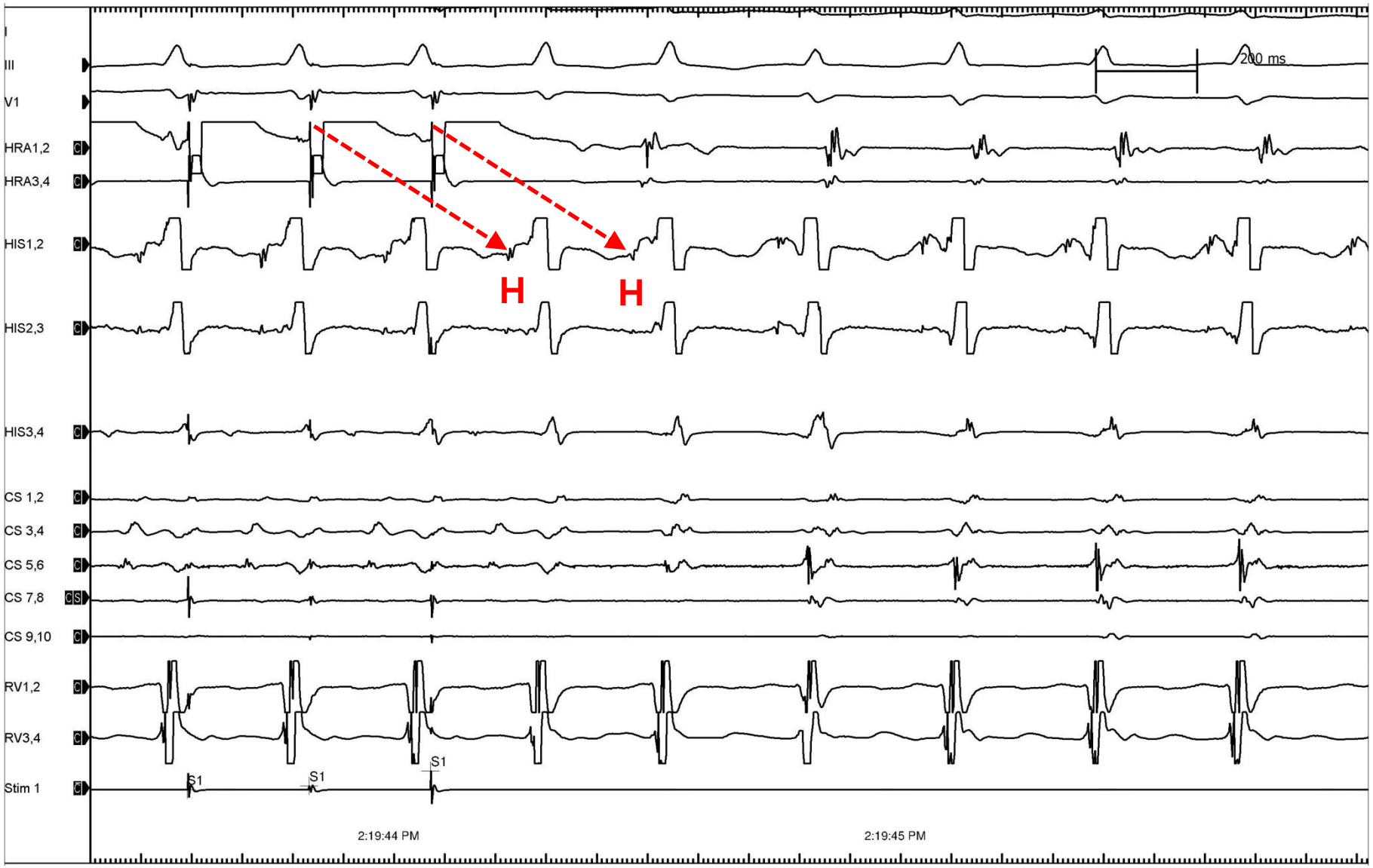
JT



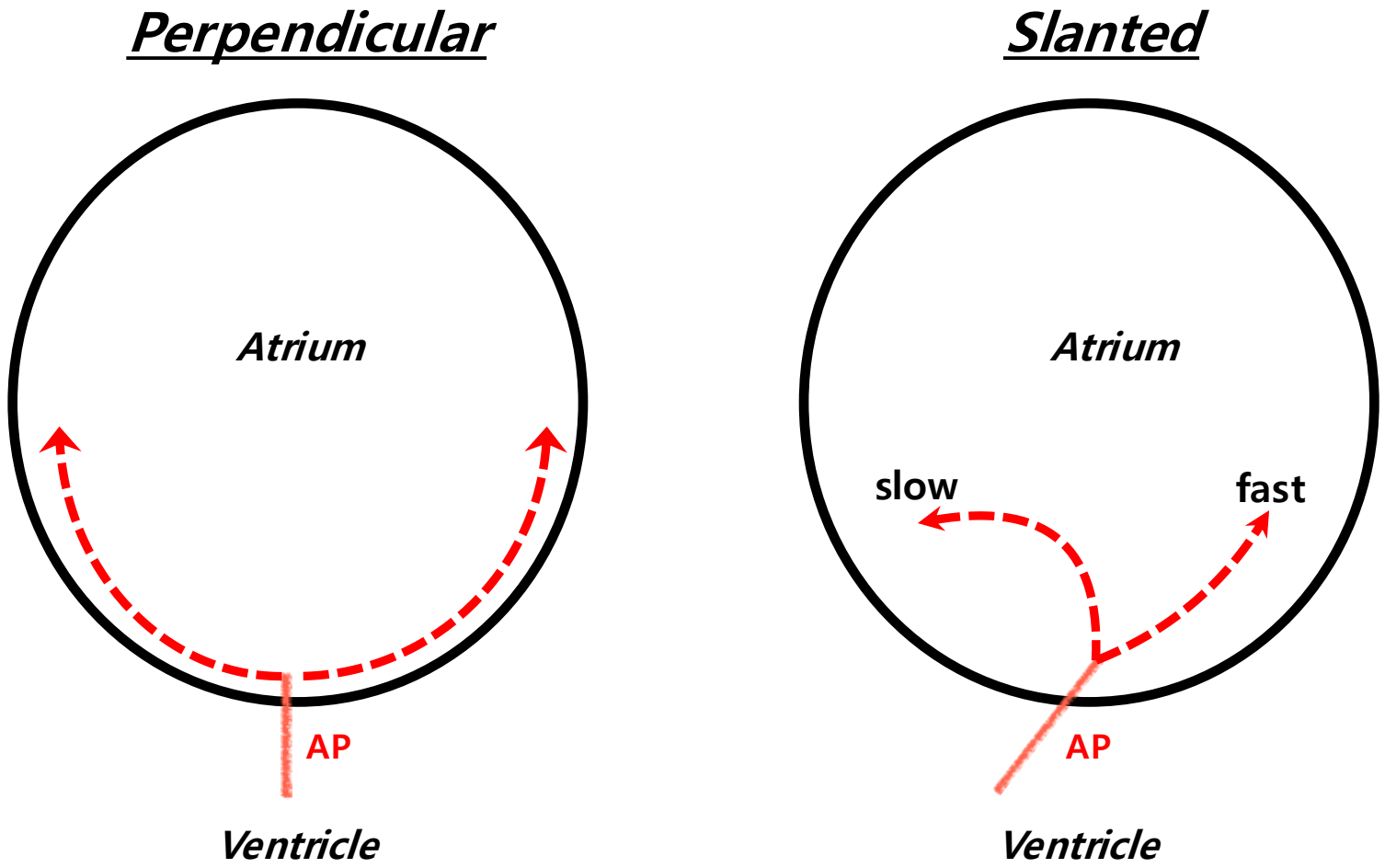
AVNRT



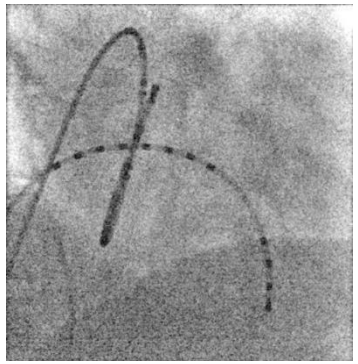
Pseudo AHHA response

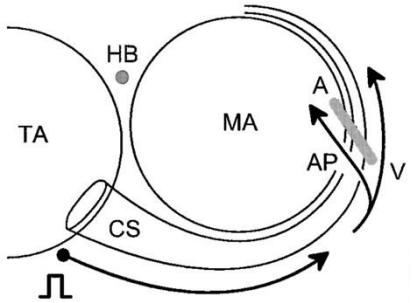


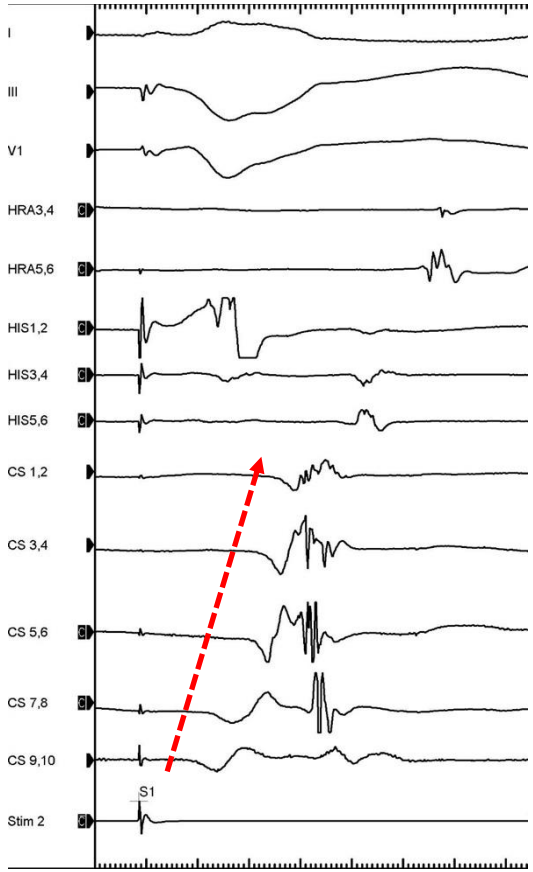
Oblique course of accessory pathway



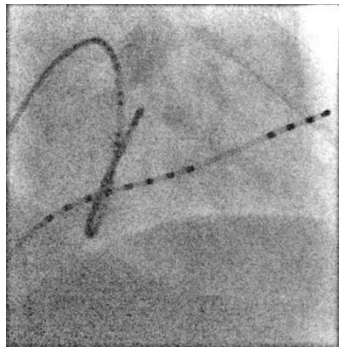
RV apex pacing

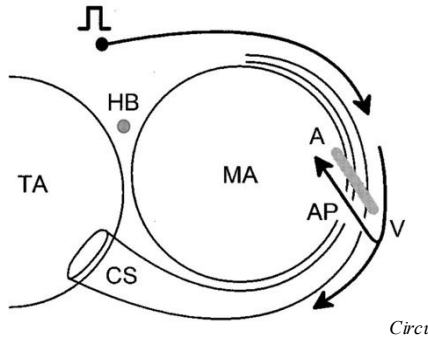




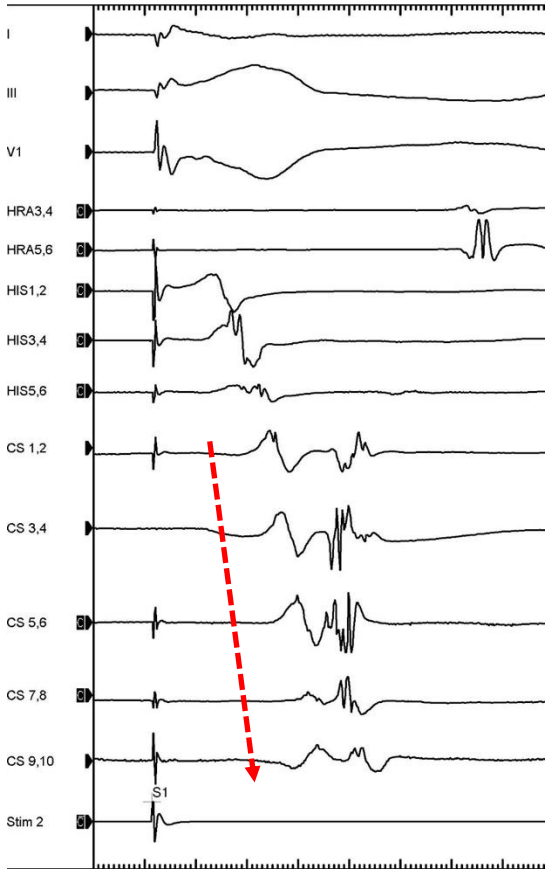


RVOT pacing

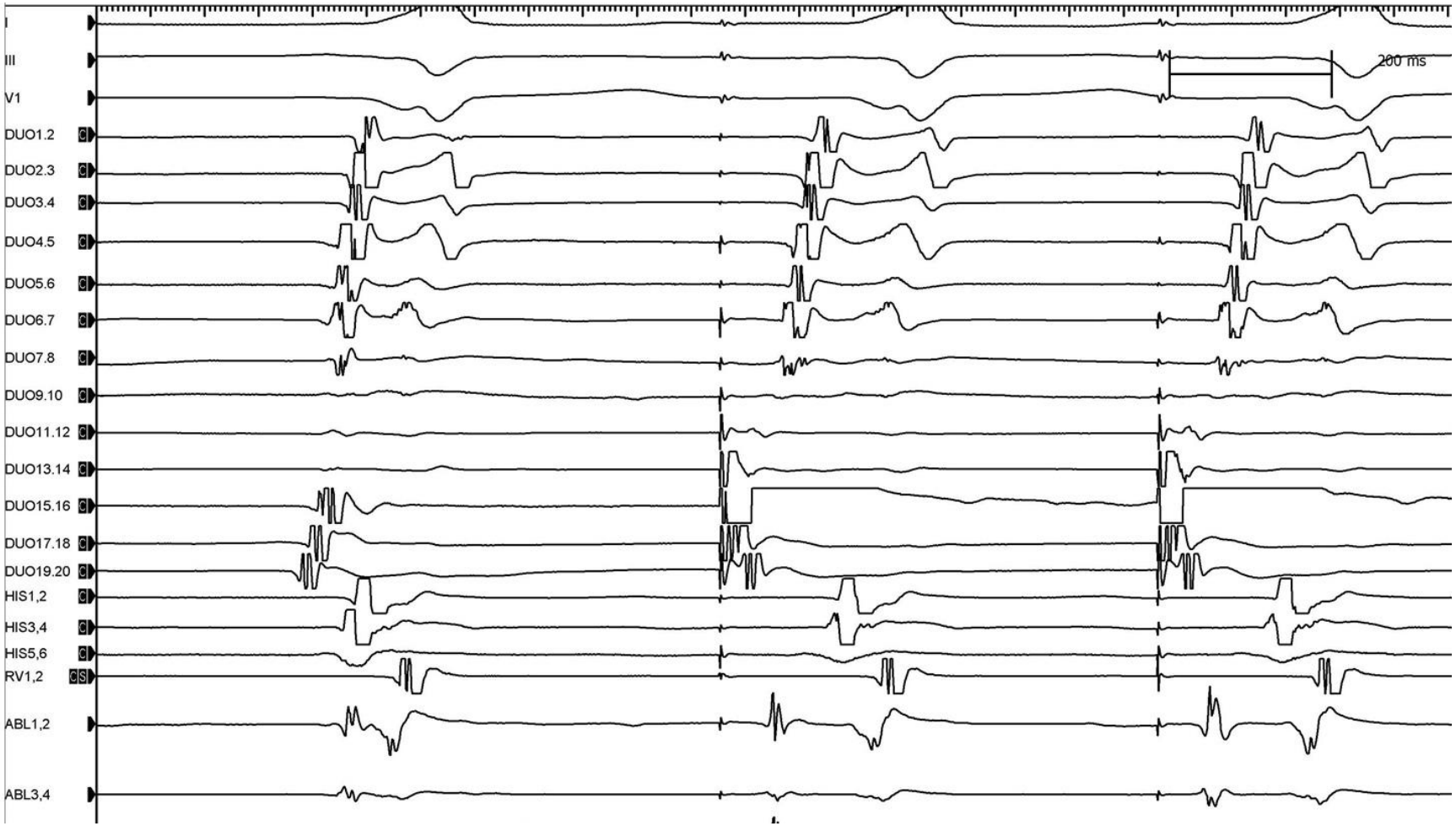




Circulation. ***2001;104:550-556.***

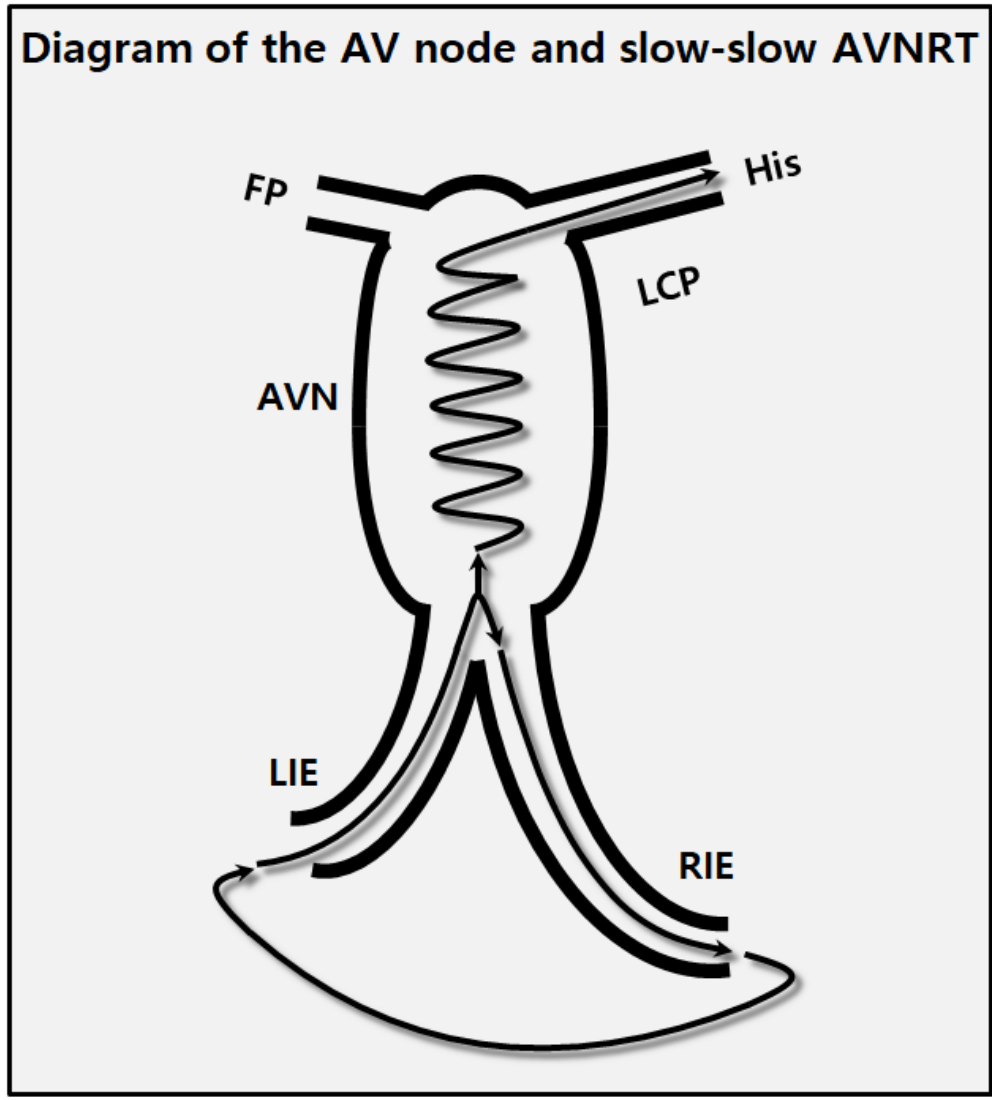


Multi-site atrial pacing for antegrade mapping



TVA 6”

Diagram of AVN and inputs



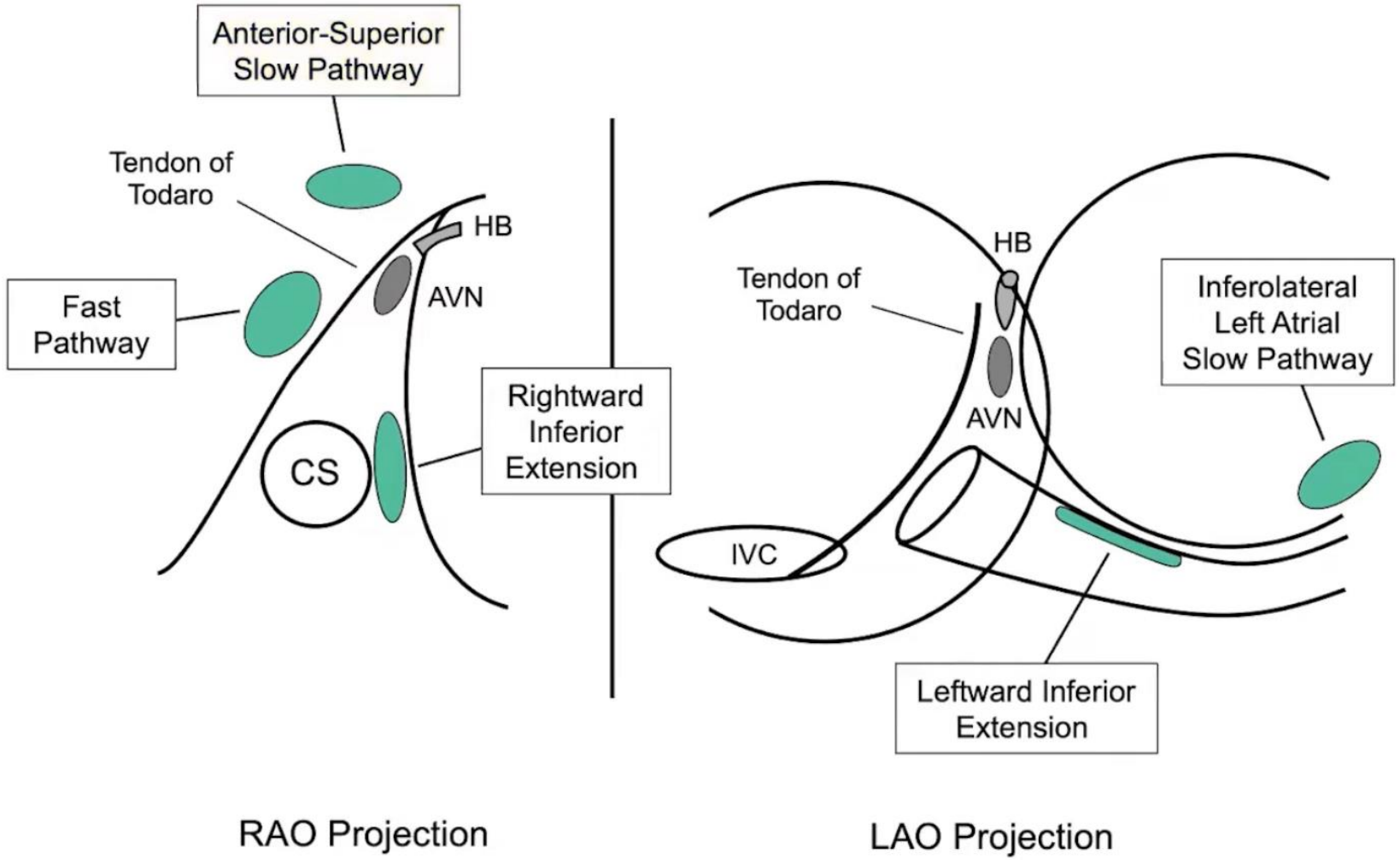
- **Classification of AVNRT**

  Slow – fast

  Fast – slow

  Slow - slow

Identification of retrograde atrial input



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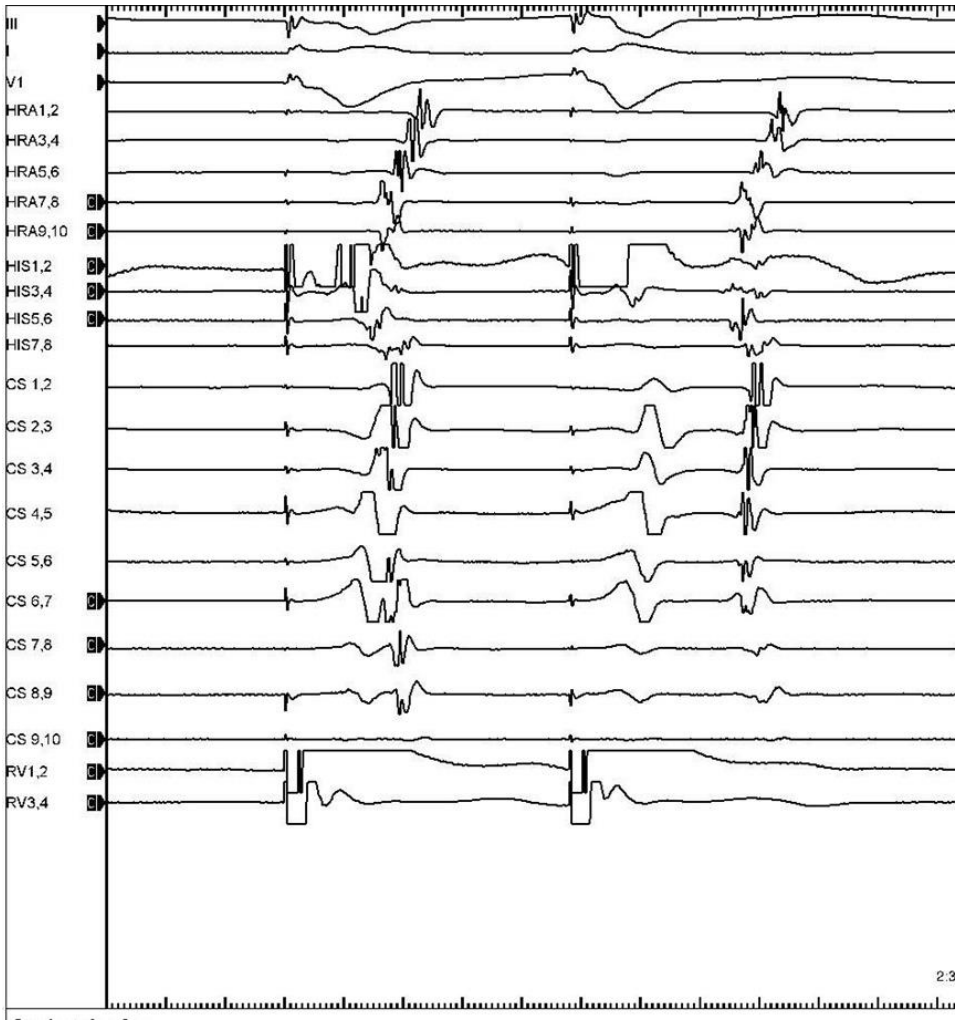
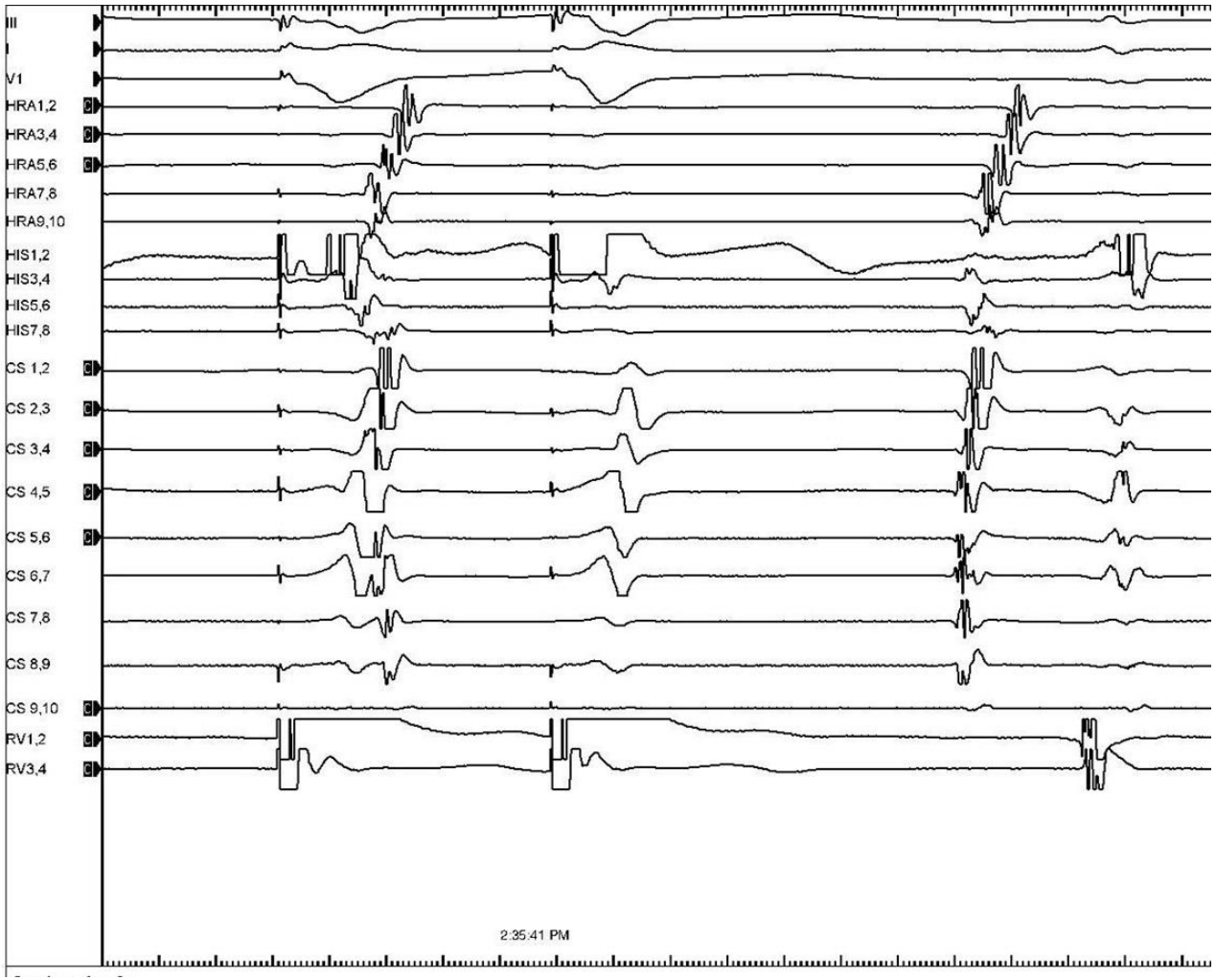
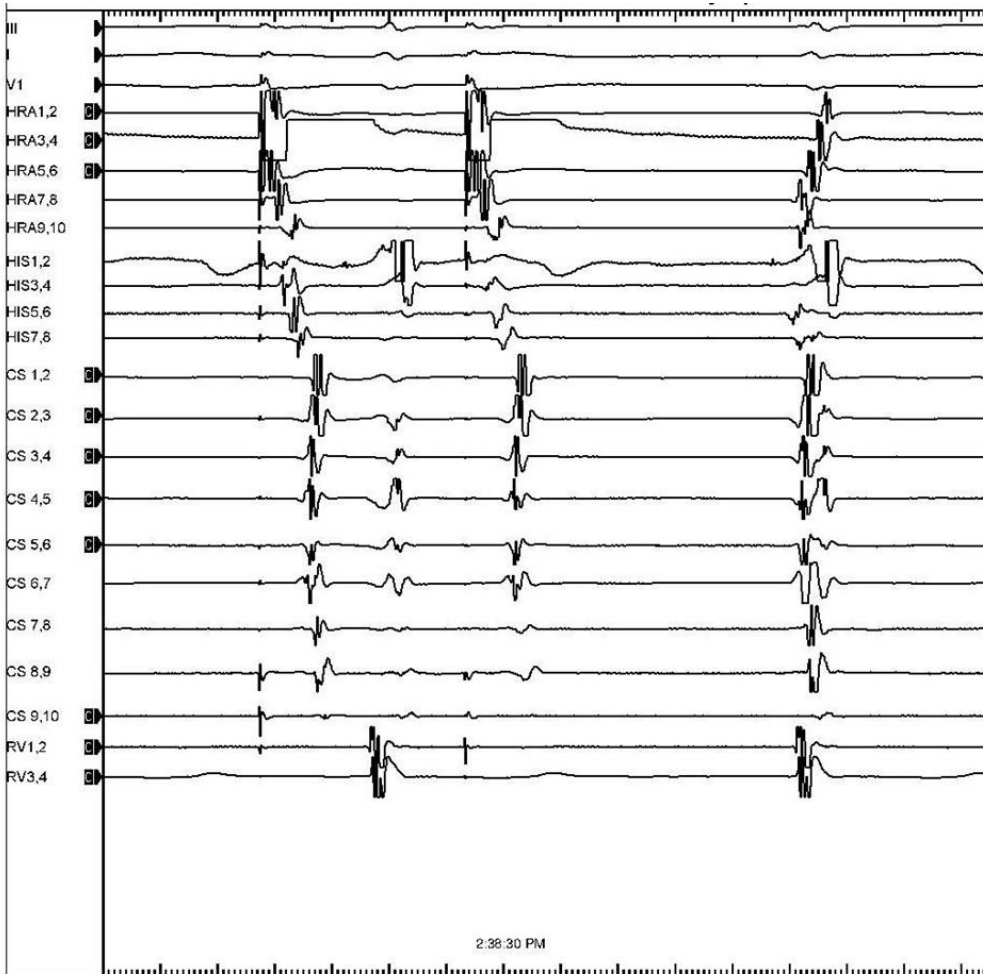
Retrograde FP conduction



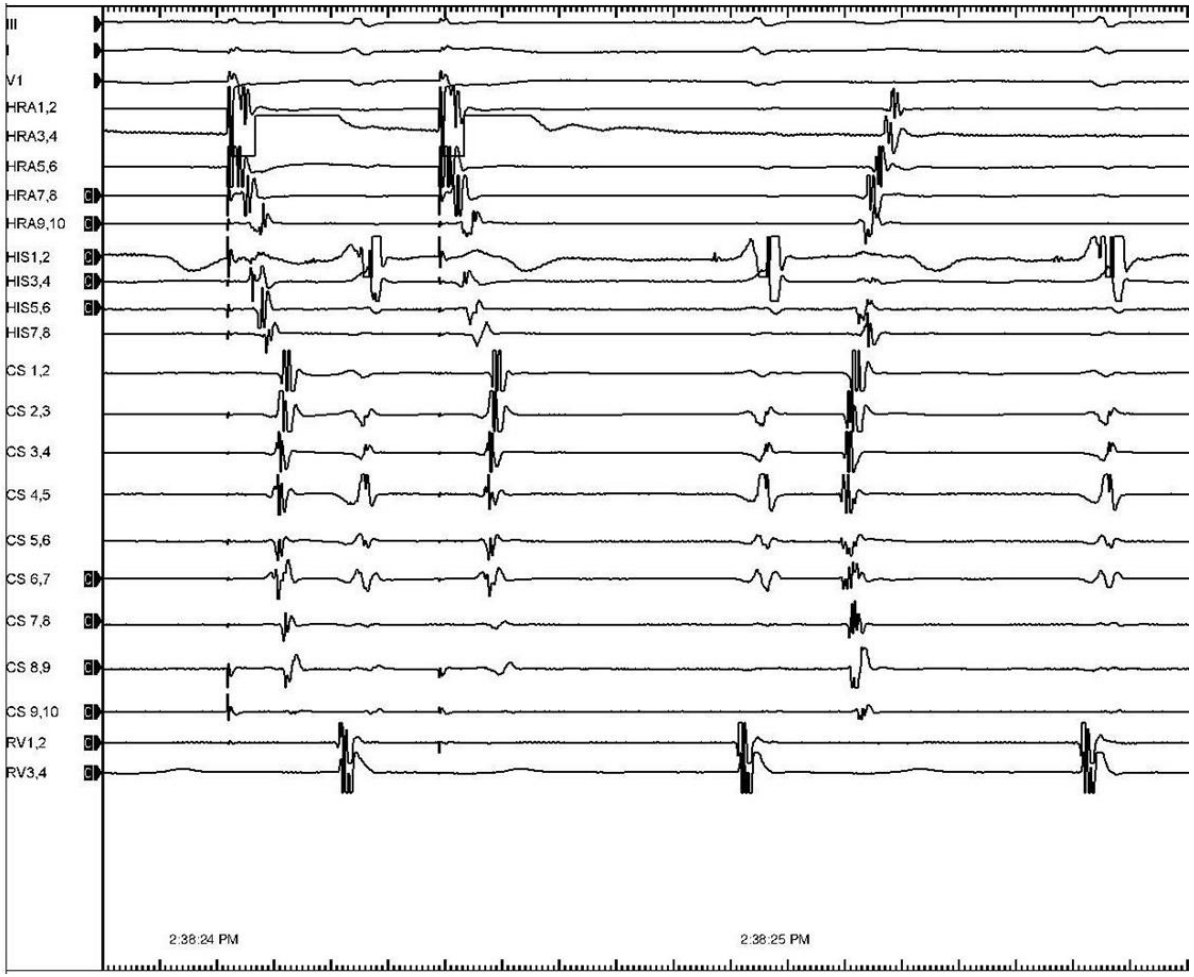
Retrograde SP conduction



Slow-Fast AVN echo beat

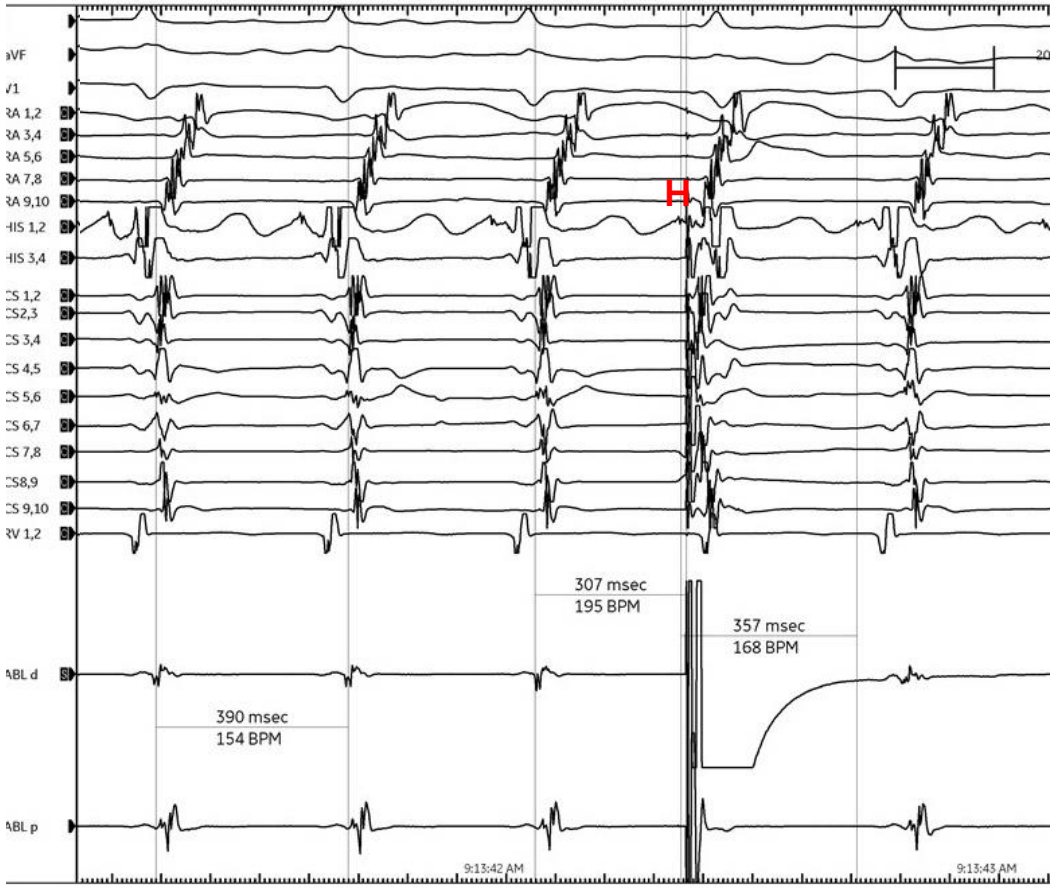


Slow-Slow AVN echo beat

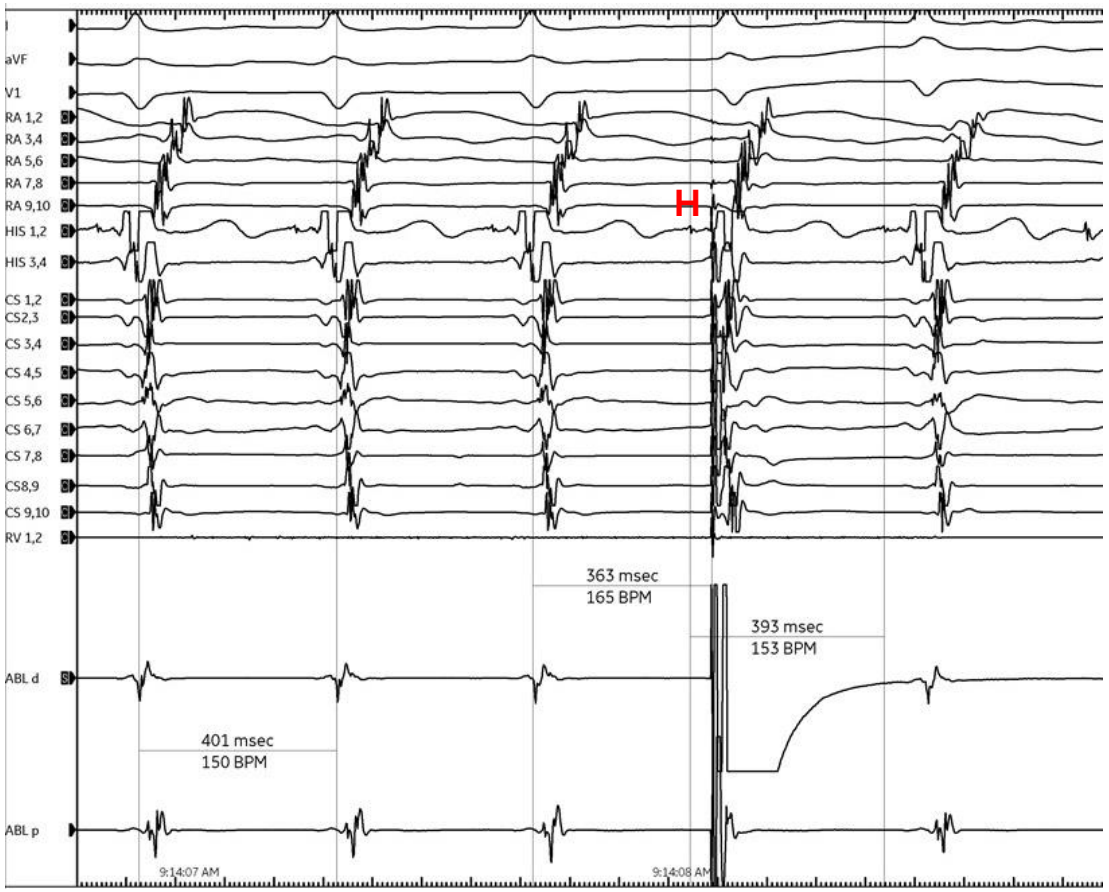


Identification of antegrade atrial input

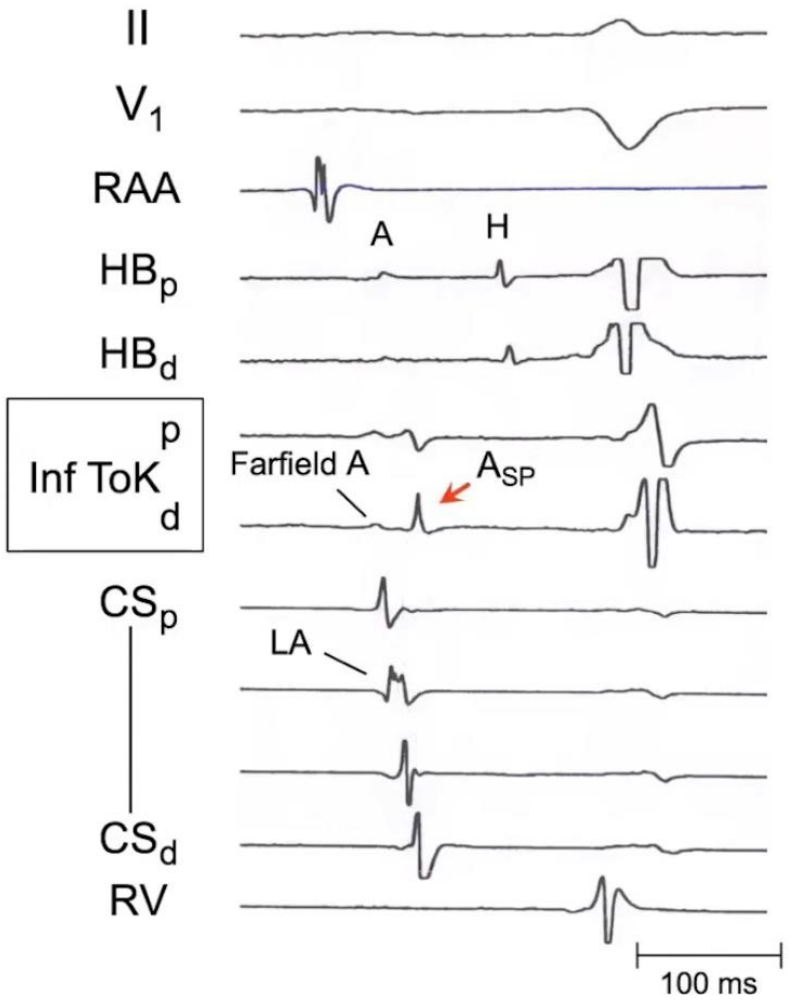
Delivery of PAC from RIE

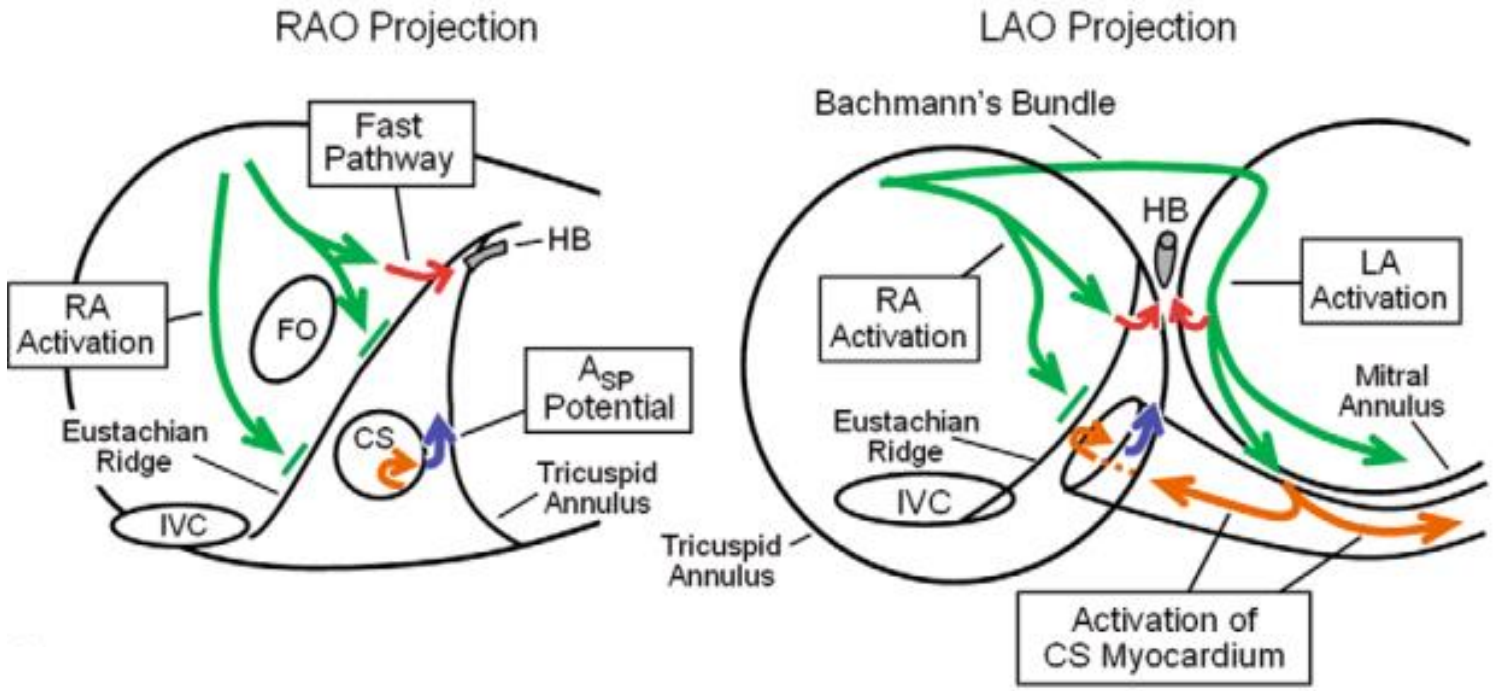


Delivery of PAC from LIE



Slow pathway potential





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경청해 주셔서 감사합니다