Fast Slow AVNRT: Diagnosis and Ablation

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COI Disclosure

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The authors have no financial conflicts of interest to disclose concerning the presentation

Classification of AVNRT types

Table. Classification of AVNRT Types*

	AH/HA	VA (His)	Usual ERAA
Typical AVNRT			
Slow-fast	>1	<60 ms	RHis, CS os, LHis
Atypical AVNRT			
Fast-slow	<1	>60 ms	CS os, LRAS, dCS
Slow-slow	>1	>60 ms	CS os, dCS

VA indicates interval measured from the onset of ventricular activation on surface ECG to the earliest deflection of the atrial activation in the His bundle electrogram; ERAA, earliest retrograde atrial activation; RHis, His bundle electrogram recorded from the right septum; LHis, His bundle electrogram recorded from the left septum; LRAS, low right atrial septum; CS os, ostium of the coronary sinus; and dCS, distal coronary sinus.

*Variable earliest retrograde atrial activation has been described for all types of AVNRT.

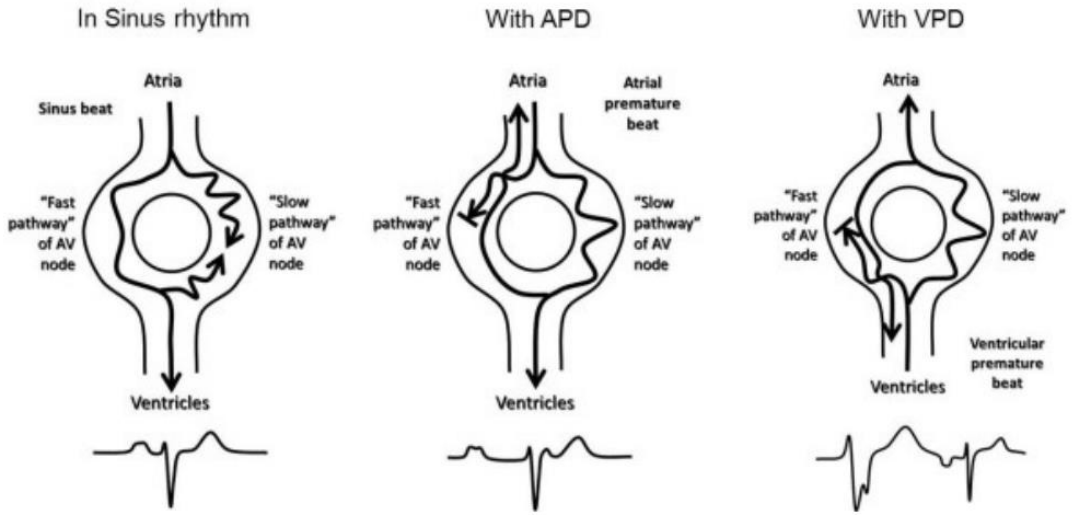

Figure 5: Model of dual AV nodal pathways physiology in sinus rhythm, with an atrial premature beat (APD) which initiates typical "slow-fast" AVNRT, and with a ventricular premature beat (VPD) which initiates atypical "fast-slow" AVNRT. See text for details.

Circulation. 2010;122:831-840.
Indian Pacing and Electrophysiology Journal. 2014;14(1):12-25.

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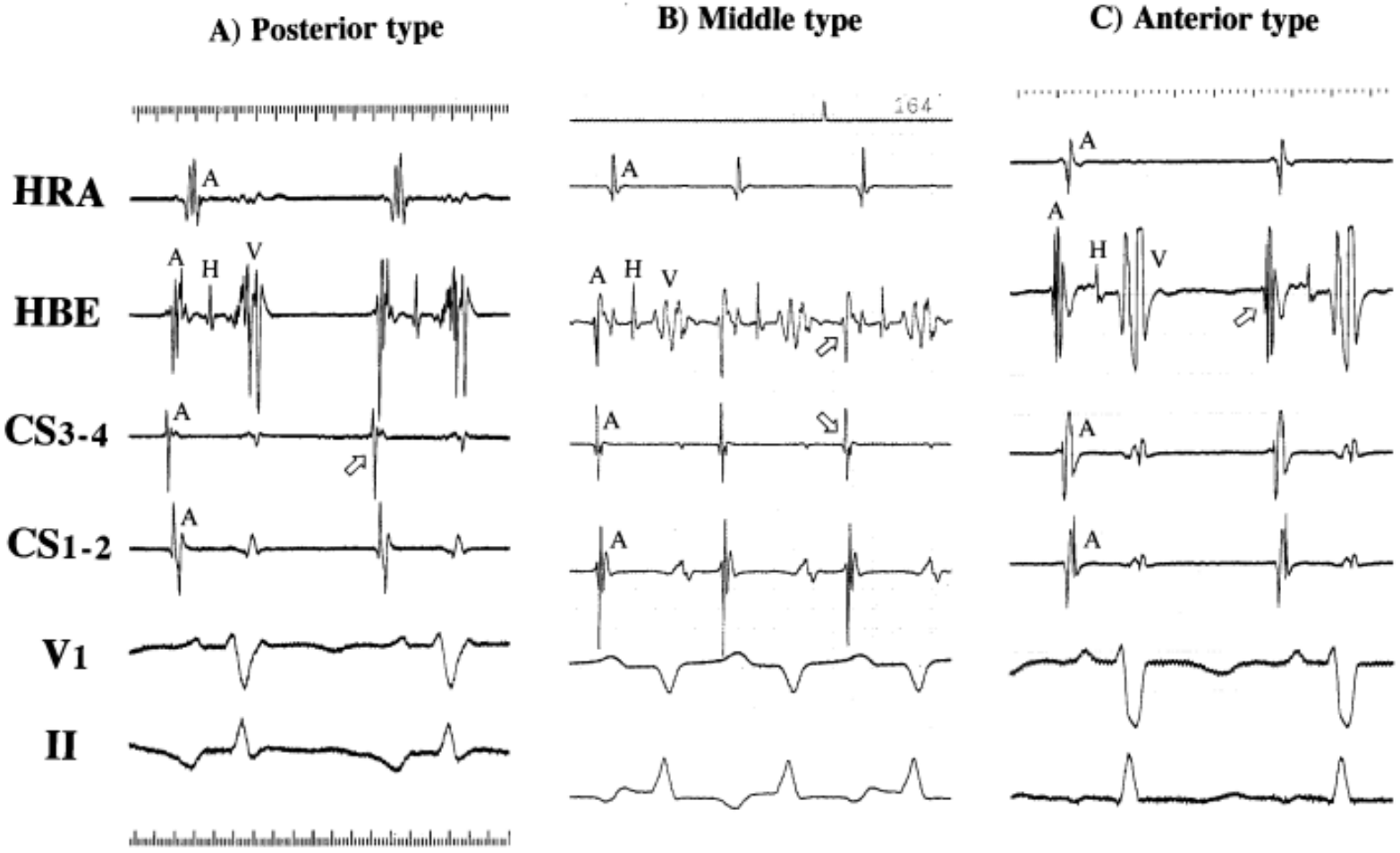
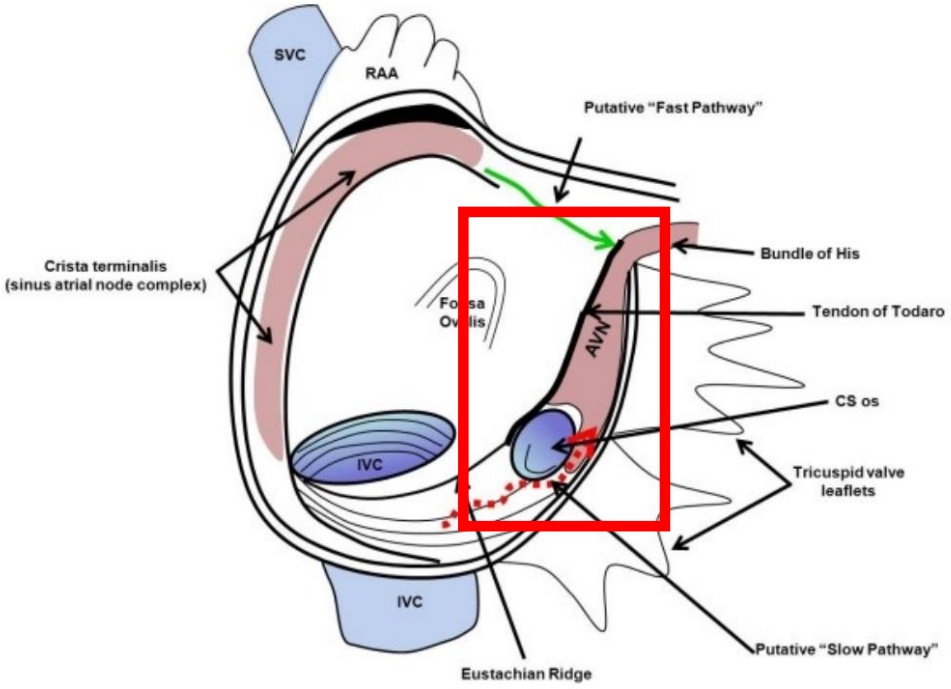
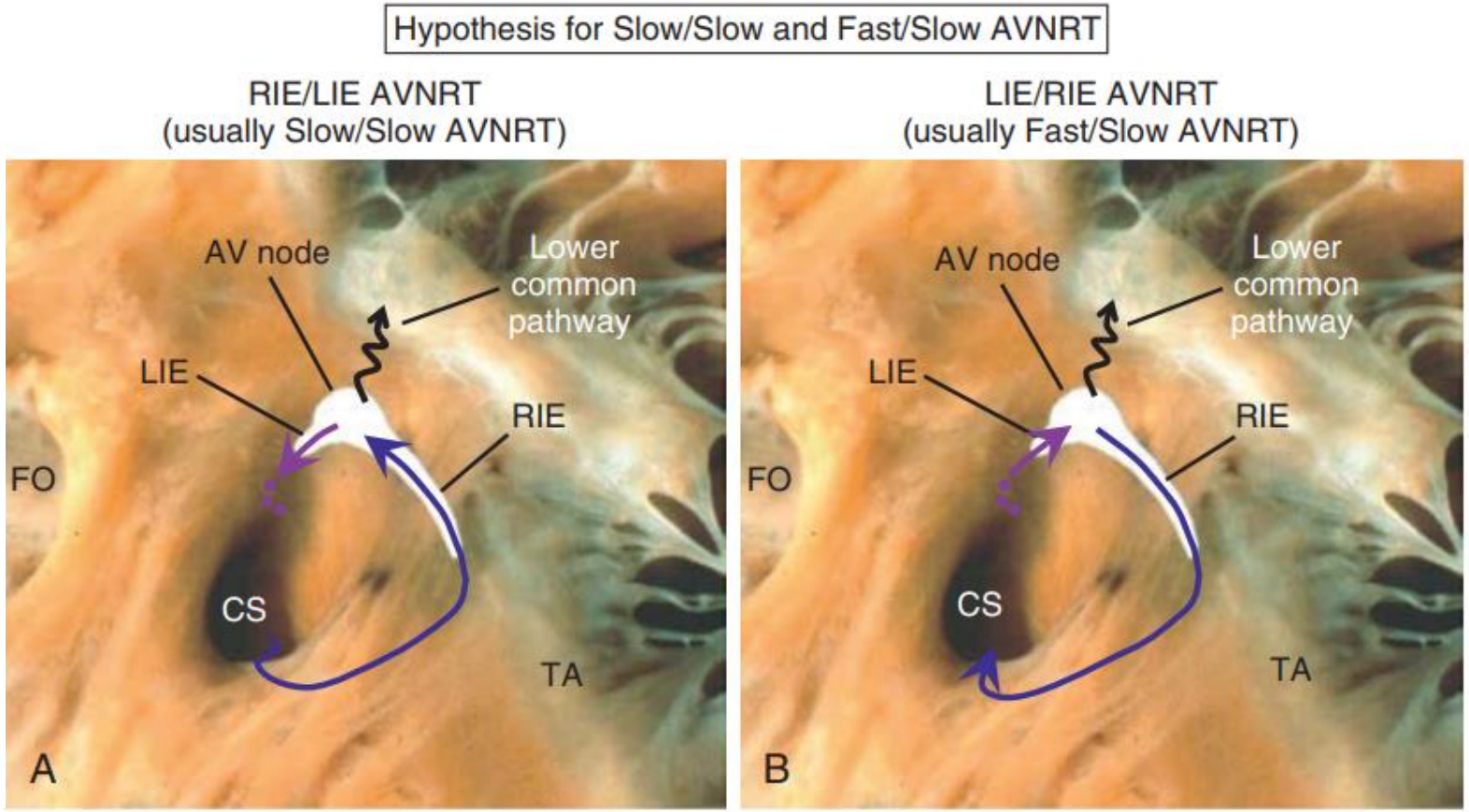
Types of Fast/Slow AVNRT



H Nawata, F Suzuki, et al. J Am Coll Cardiol 1998; 32: 1731-40.

Hypothesis of Fast/Slow AVNRT





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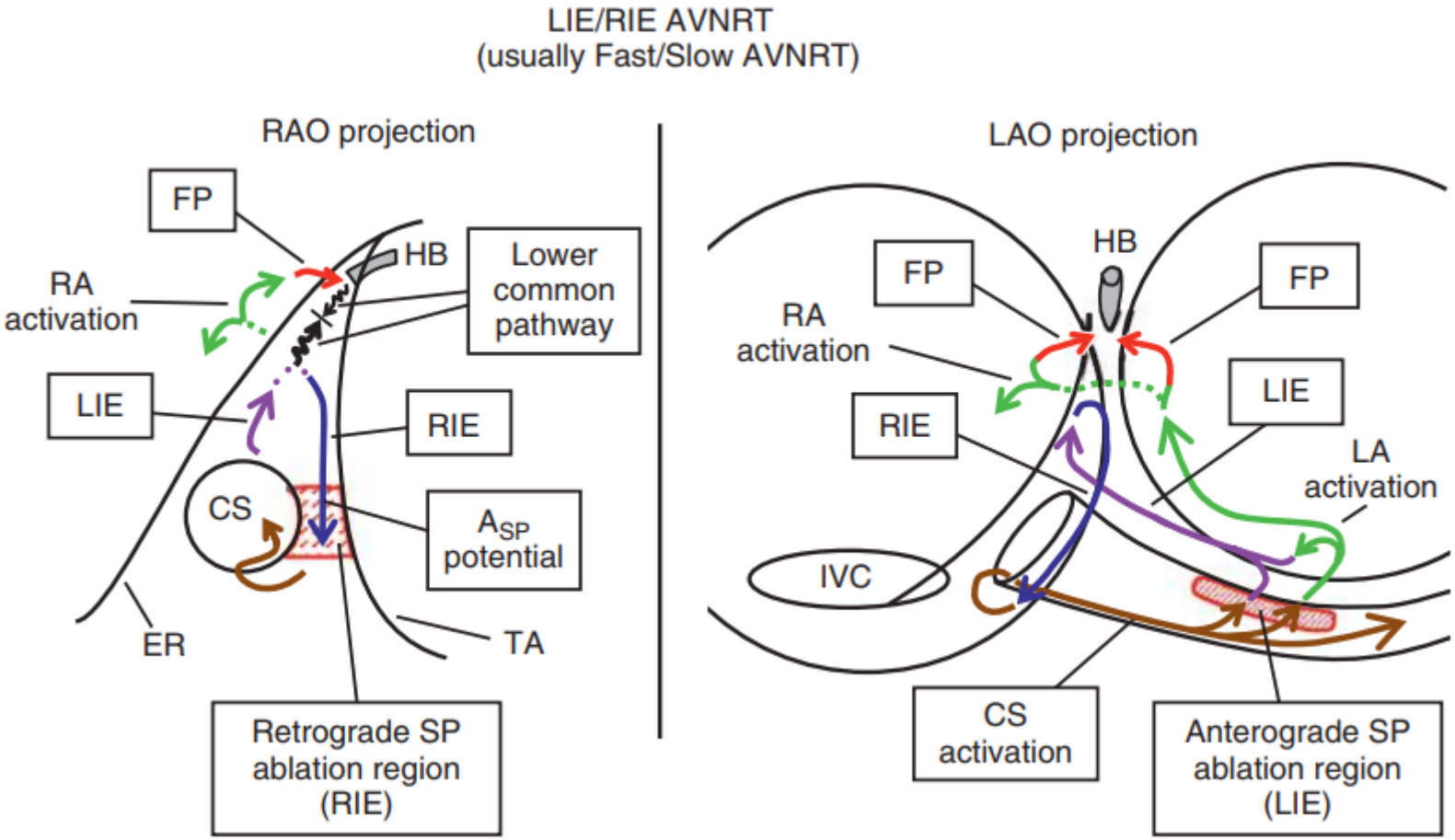
Lockwood D, Jackman WM, et al. Zipes and Jalife's Cardiac Electrophysiology: From Cell to Bedside 8e 2022.

Hypothesis of Fast/Slow AVNRT



Lockwood D, Jackman WM, et al. Zipes and Jalife's Cardiac Electrophysiology: From Cell to Bedside 8e 2022.

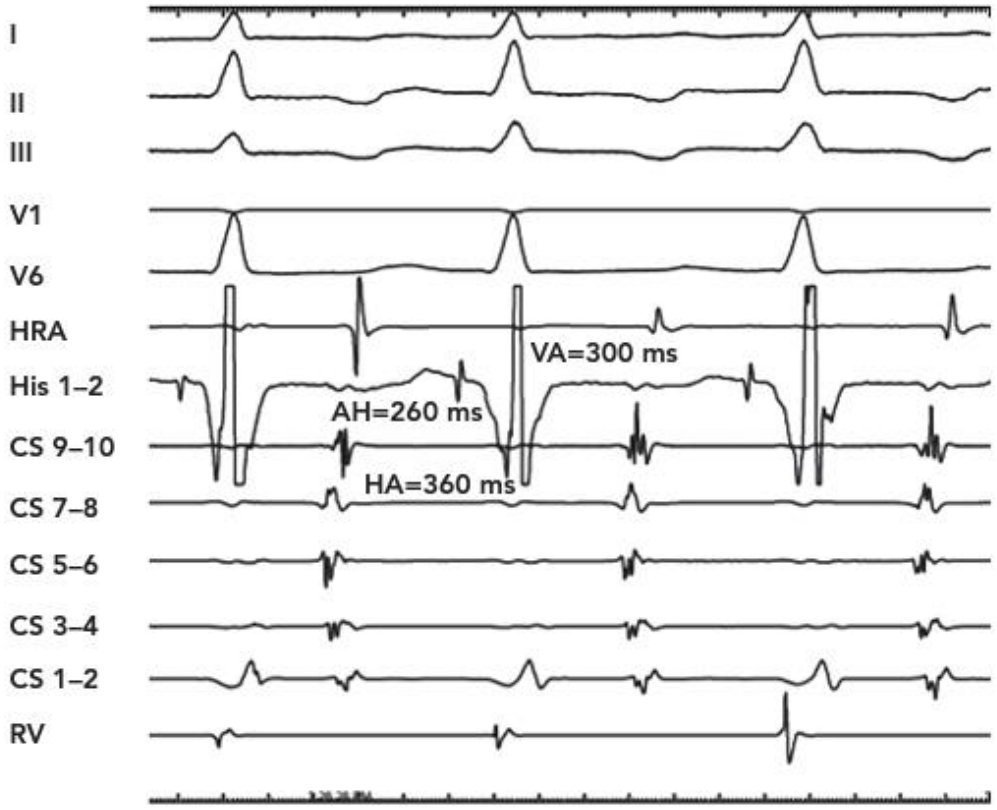
Atypical AVNRT (Fast-Slow)

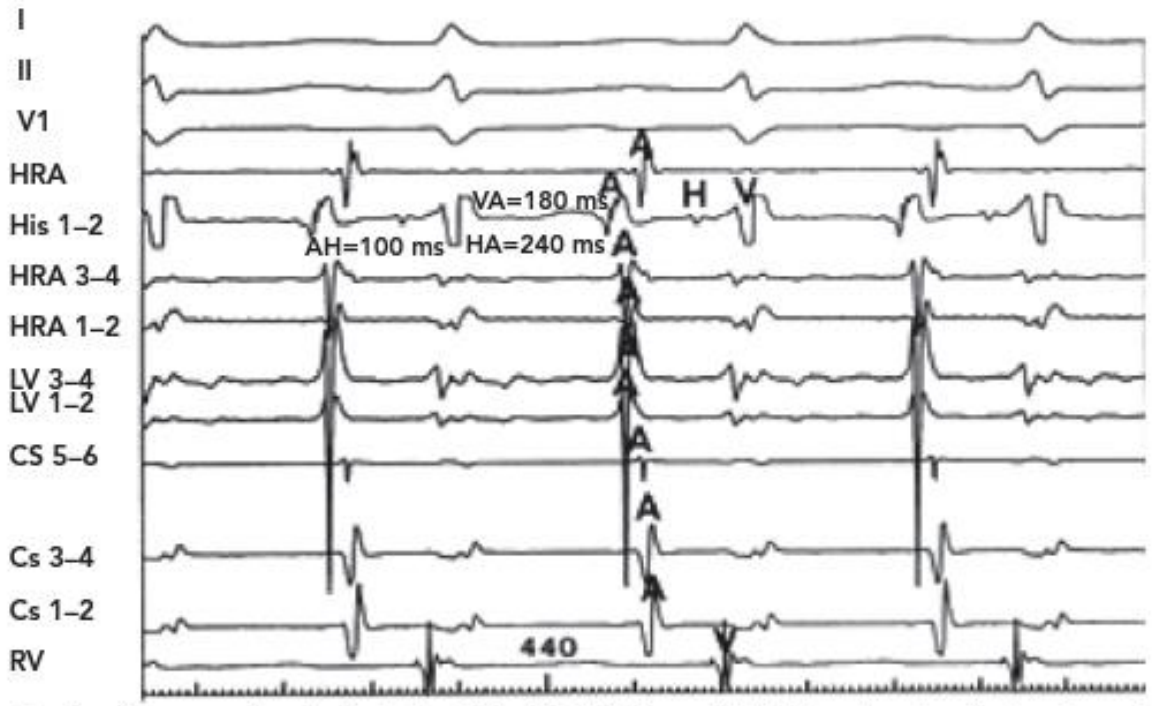
In the fast-slow form of AVNRT(≈ 5% to 10% of all AVNRT cases)

- Retrograde atrial electrograms begin after ventricular activation, with an AH/HA ratio <1.
- VA interval in His bundle electrogram is > 60 ms, and in the high RA, it is >100ms
- The earliest retrograde atrial activation is at the base of the triangle of Koch, near the CS os and uncommon at the lower septum or distal CS.

DG Katritsis, AJ Camm, Circulation. 2010;122:831-840.

AH < HA, VA > 60~100 ms

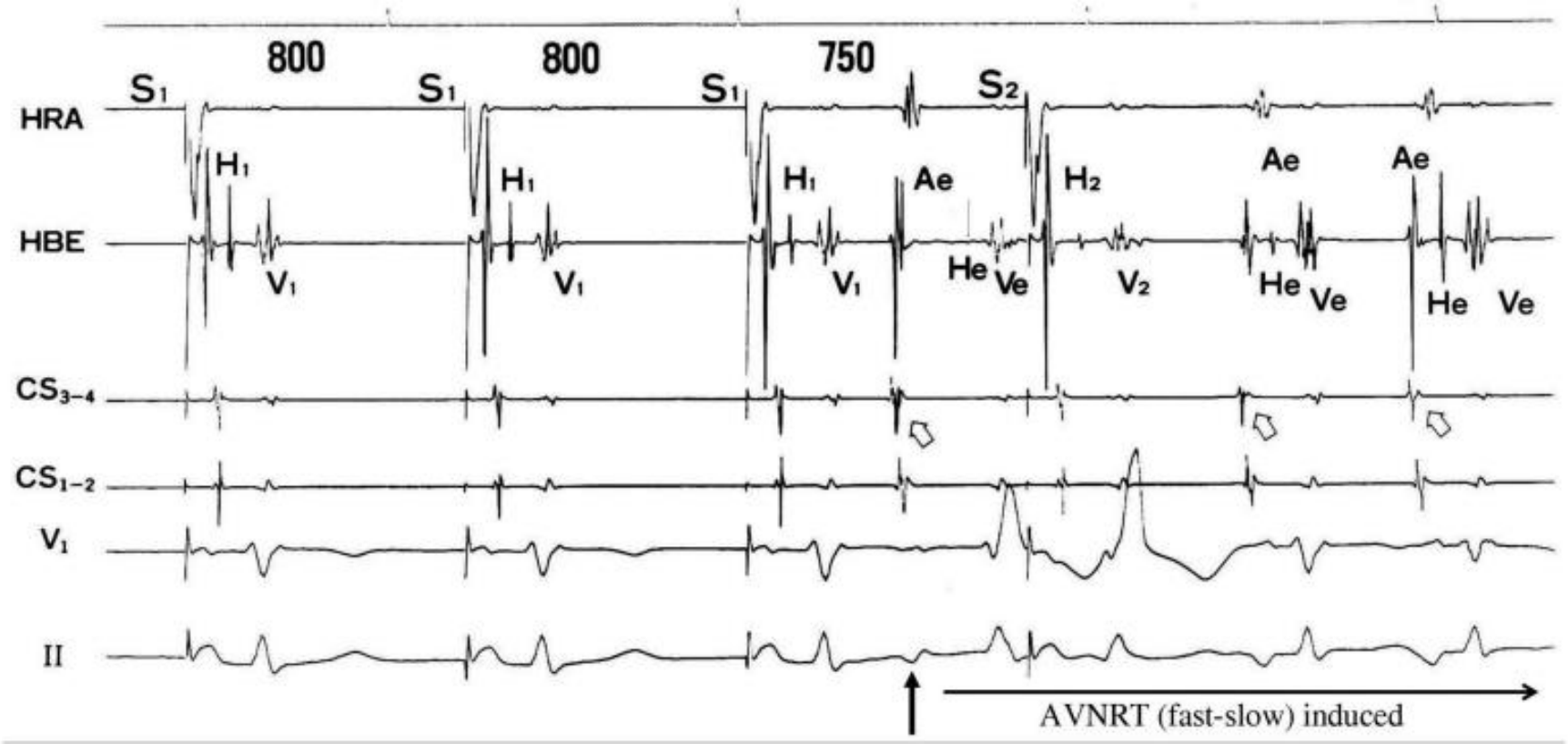




The form is conventionally fast-slow (AH<HA, HA>70 ms, AH<200 ms), and earliest retrograde atrial activation recorded at the His bundle electrode. I to V6: 12-lead ECG leads; CS = coronary sinus; His = His bundle electrogram; HRA = high right atrium; LV = left ventricle; RV = right ventricle.[5]

DG Katritsis, ME Josephson. Arrhythmia & Electrophysiology Review 2016;5(2):130–5 DOI: 10.15420/AER.2016.18.2

EGM (Induction of Fast/Slow AVNRT)



F Suzuki, APHRS News Nov.2014, No16

EGM (Termination of Fast/Slow AVNRT by adenosine)

Superior-type

Inferolateral SP

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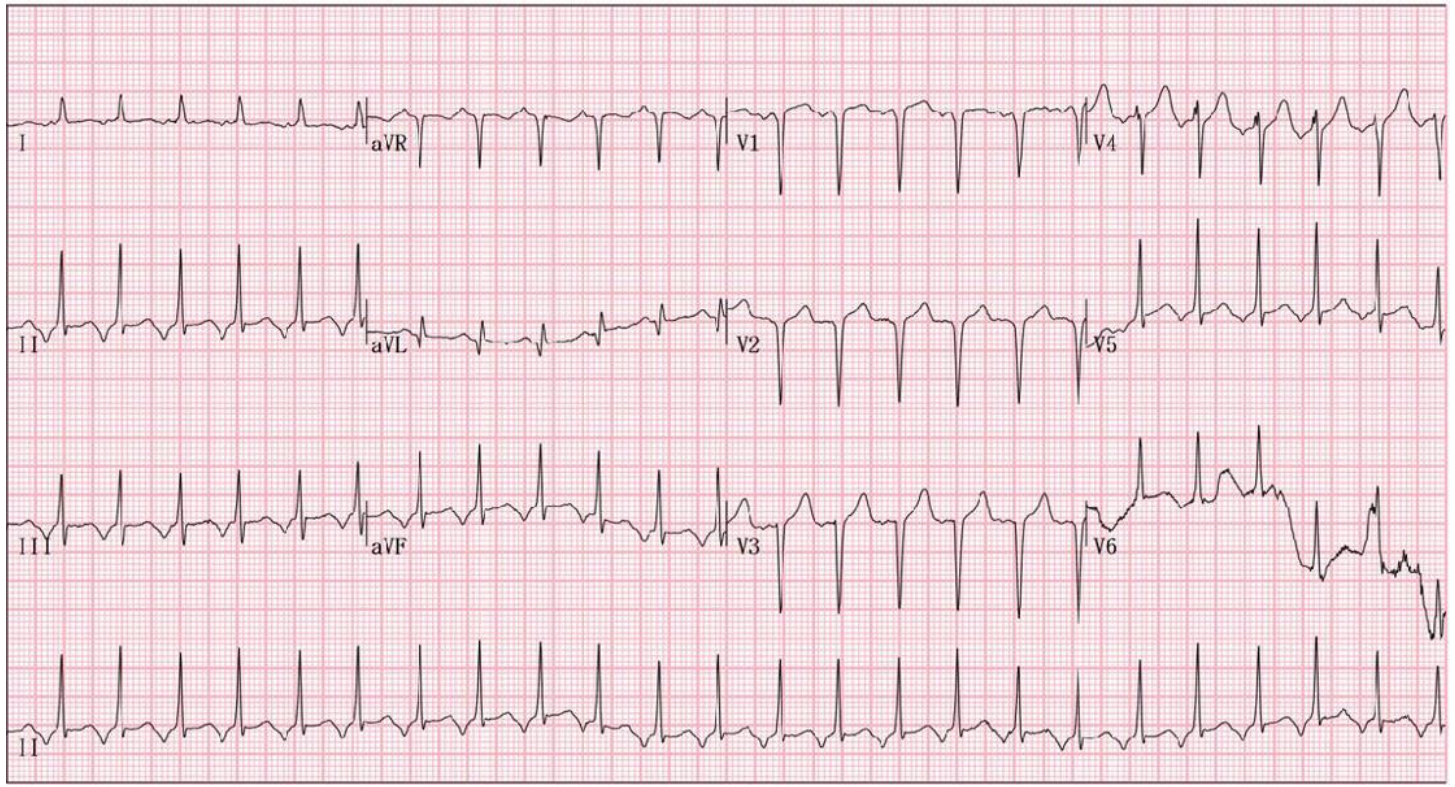
ECG (Fast/Slow AVNRT)



The RP interval is long favoring atypical fast-slow AVNRT as the SVT mechanism. The retrograde P wave is inscribed immediately before the QRS complex and is superimposed on the T wave.

Indian Pacing and Electrophysiology Journal. 2014;14(1):12-25.

ECG (Fast/Slow AVNRT)

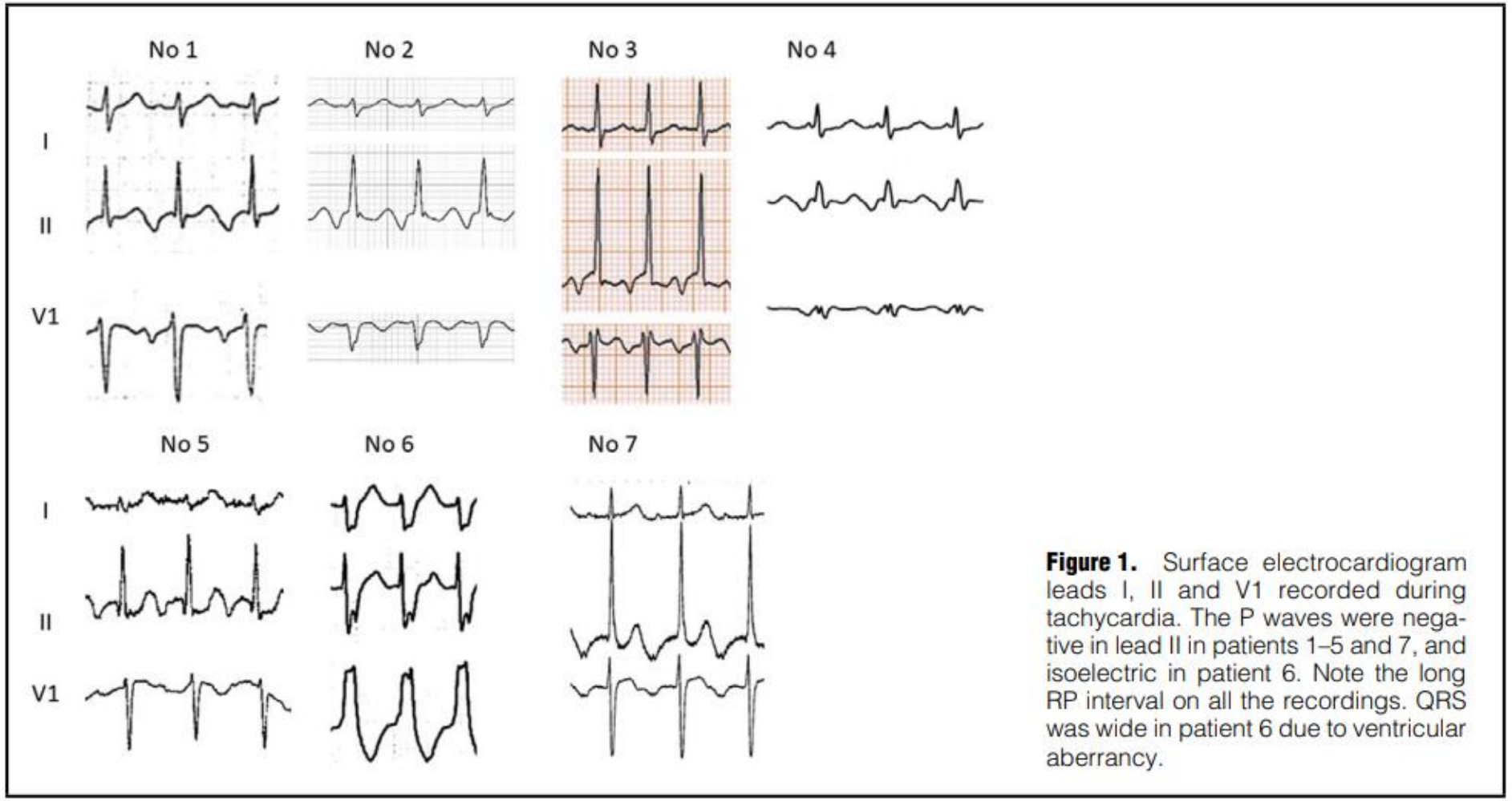


Figure 1. Surface electrocardiogram leads I, II and V1 recorded during tachycardia. The P waves were negative in lead II in patients 1–5 and 7, and isoelectric in patient 6. Note the long RP interval on all the recordings. QRS was wide in patient 6 due to ventricular aberrancy.

Y Kaneko, et al. Rev. Cardiovasc. Med. 2022; 23(11): 369

AVNRT vs. AT

Ventricular pacing

- The diagnosis of AT was excluded by 1 or both of the following observations:
  - termination of the tachycardia by ventricular pacing without atrial capture or
  - a V-A-V activation sequence after ventricular induction/reinitiation of the tachycardia resulting from retrograde conduction over the SP followed by anterograde conduction over the FP
- AT is associated with an V-A-A-V response.
- Exception: a late V electrogram might give an apparent V-A-A-V response (that is actually and V-A-H-A-V response in AVNRT or AVRT.

Circulation. 2016;133:114–123.
Circulation. 2010;122:831-840.

AVNRT vs. AT

Indicating retrograde decremental conduction via the AV node.

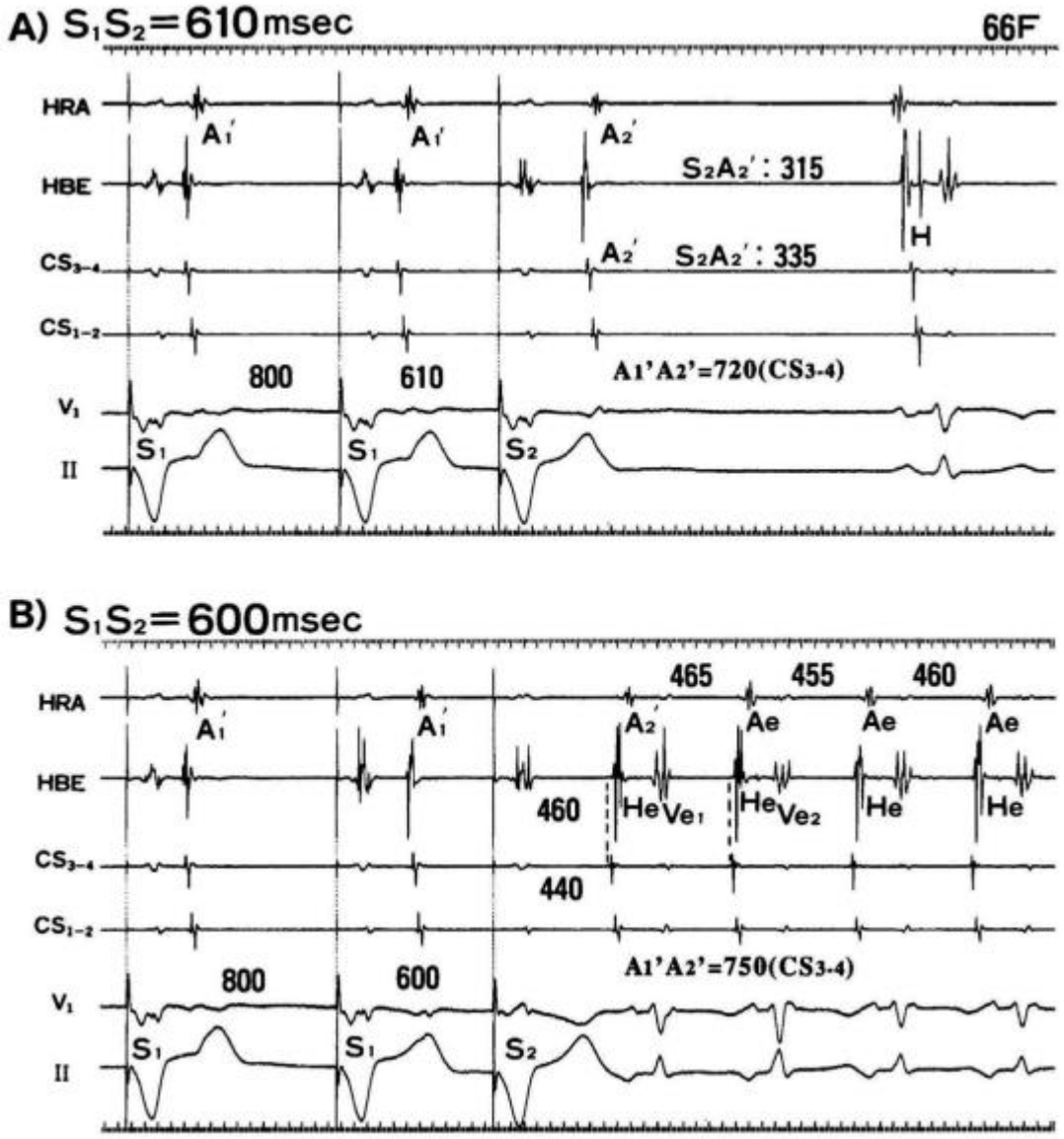


Figure 4. Induction of fast-slow AVNRT by ventricular stimulation

J Am Coll Cardiol 1998; 32: 1731-40.

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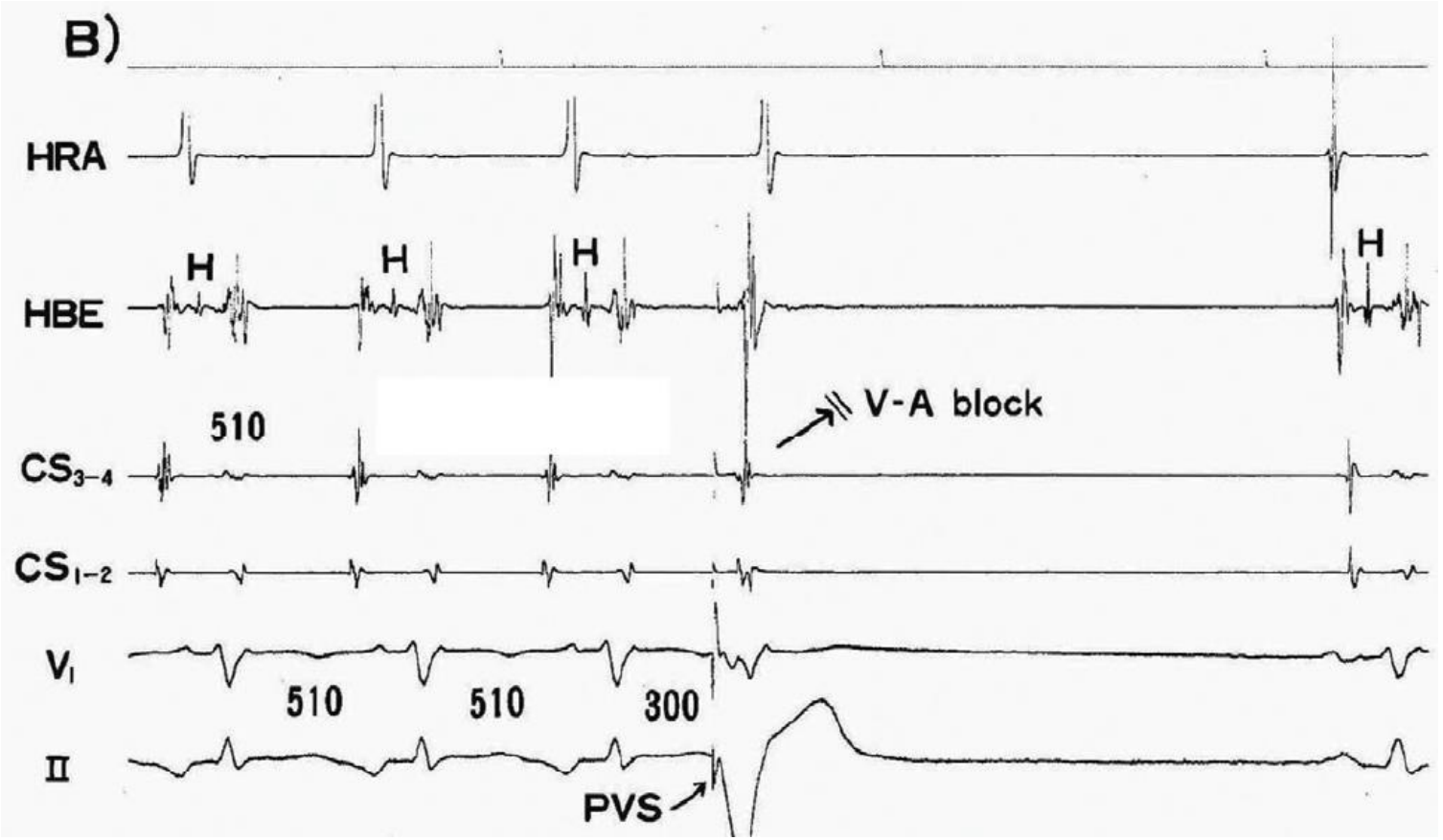
AVNRT vs. AT

VA block

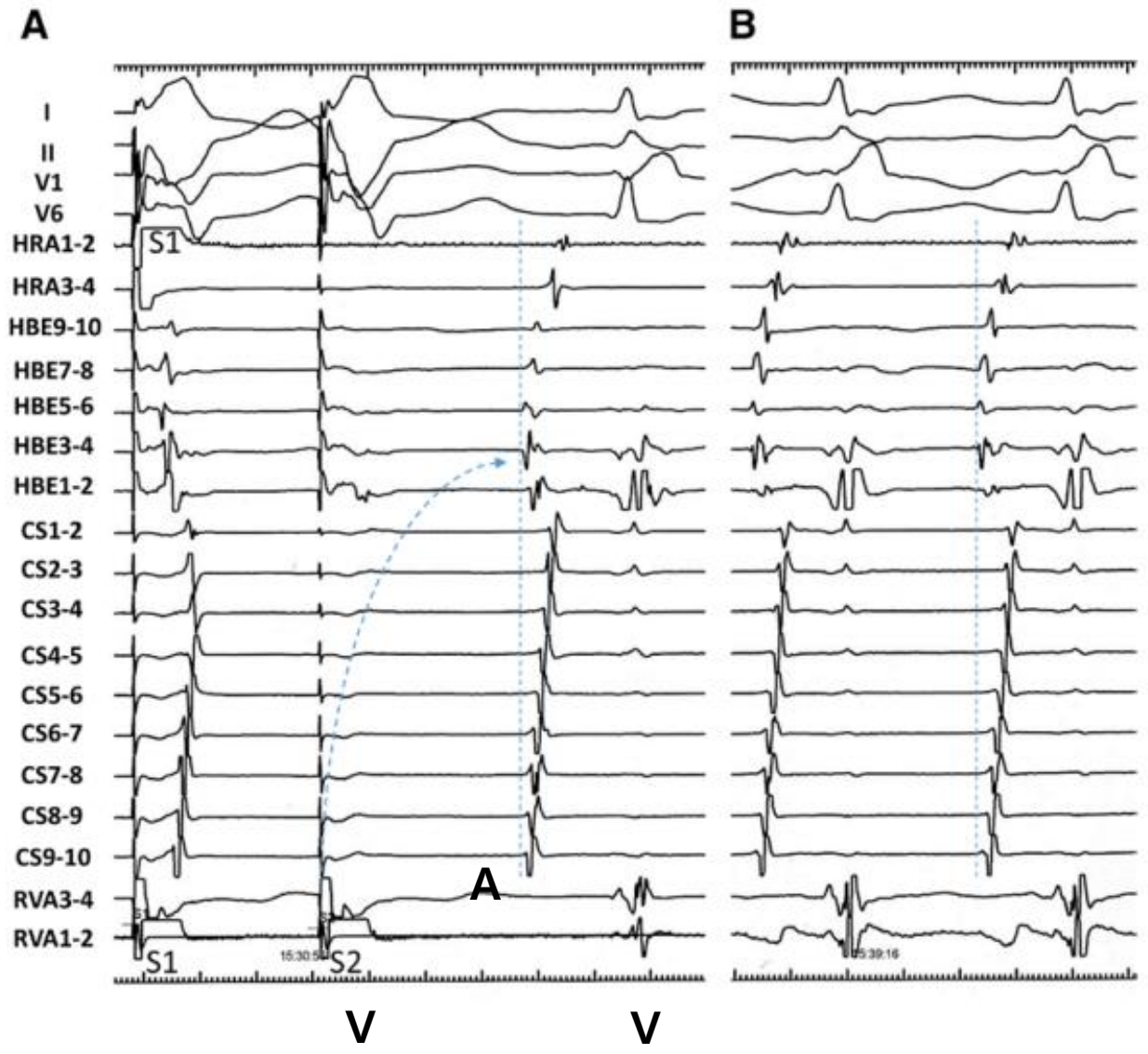
Termination of the tachycardia by ventricular pacing without atrial capture



J Am Coll Cardiol 1998; 32: 1731-40.
Circulation. 2016;133:114–123

AVNRT vs. AT

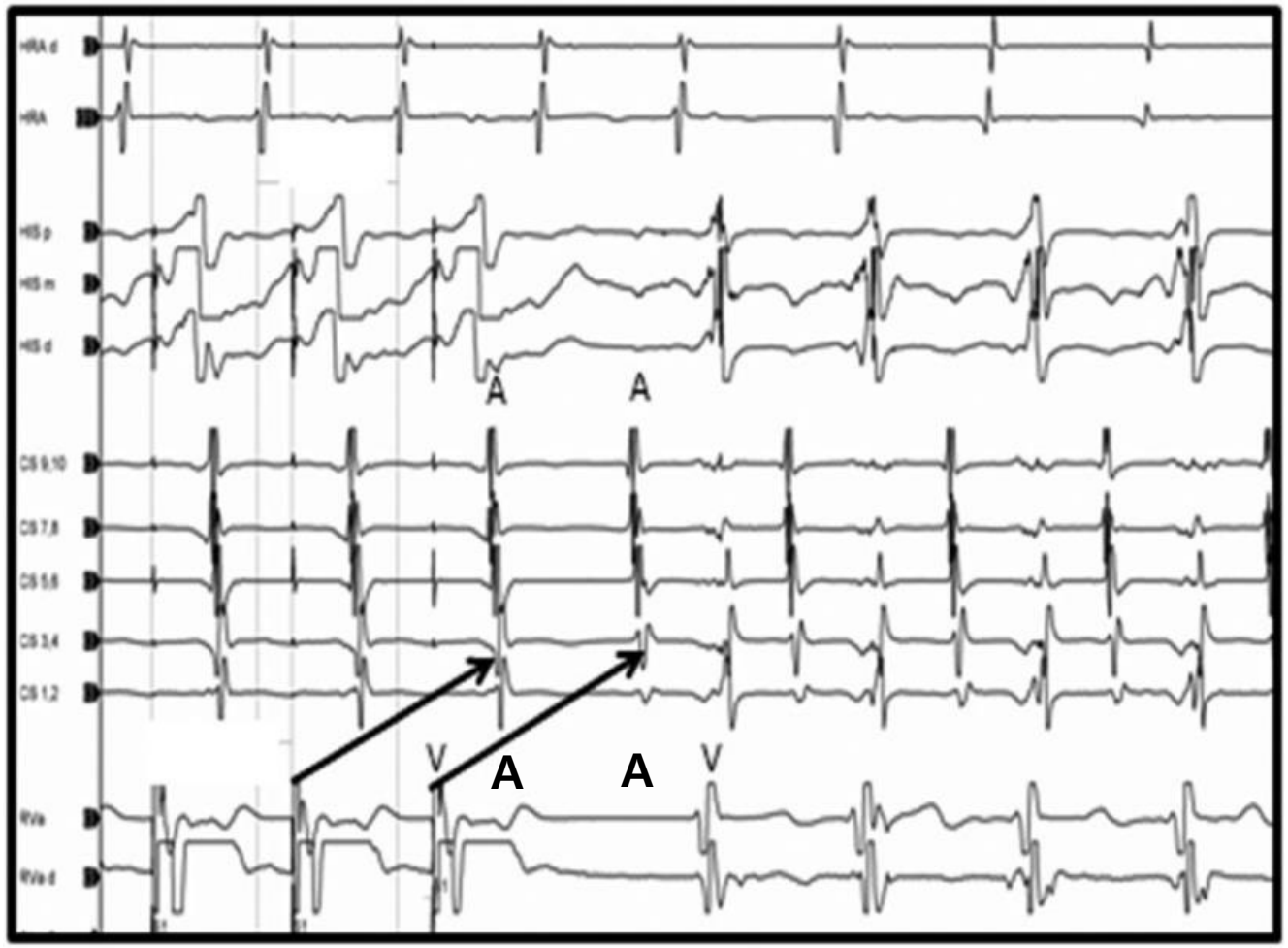
a V-A-V activation sequence after ventricular induction/reinitiation of the tachycardia



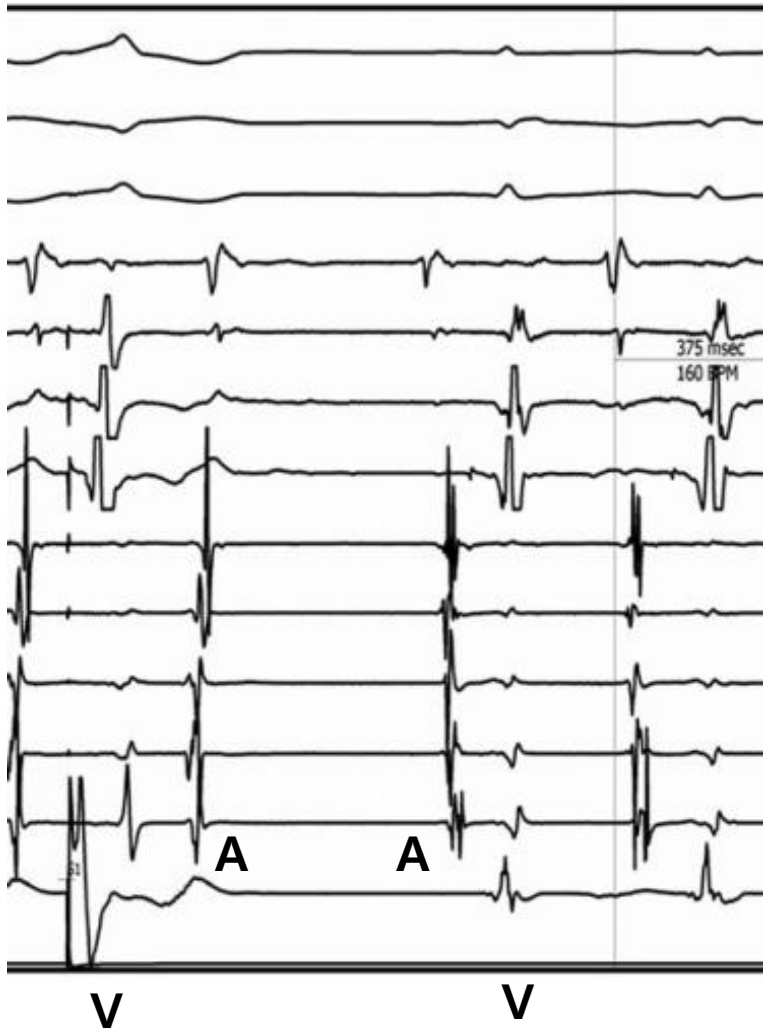
Circulation. 2016;133:114–123

AVNRT vs. AT

Pseudo-VAAV



AT



The Journal of Innovations in Cardiac Rhythm Management, 4 (2013), 1217–1230.

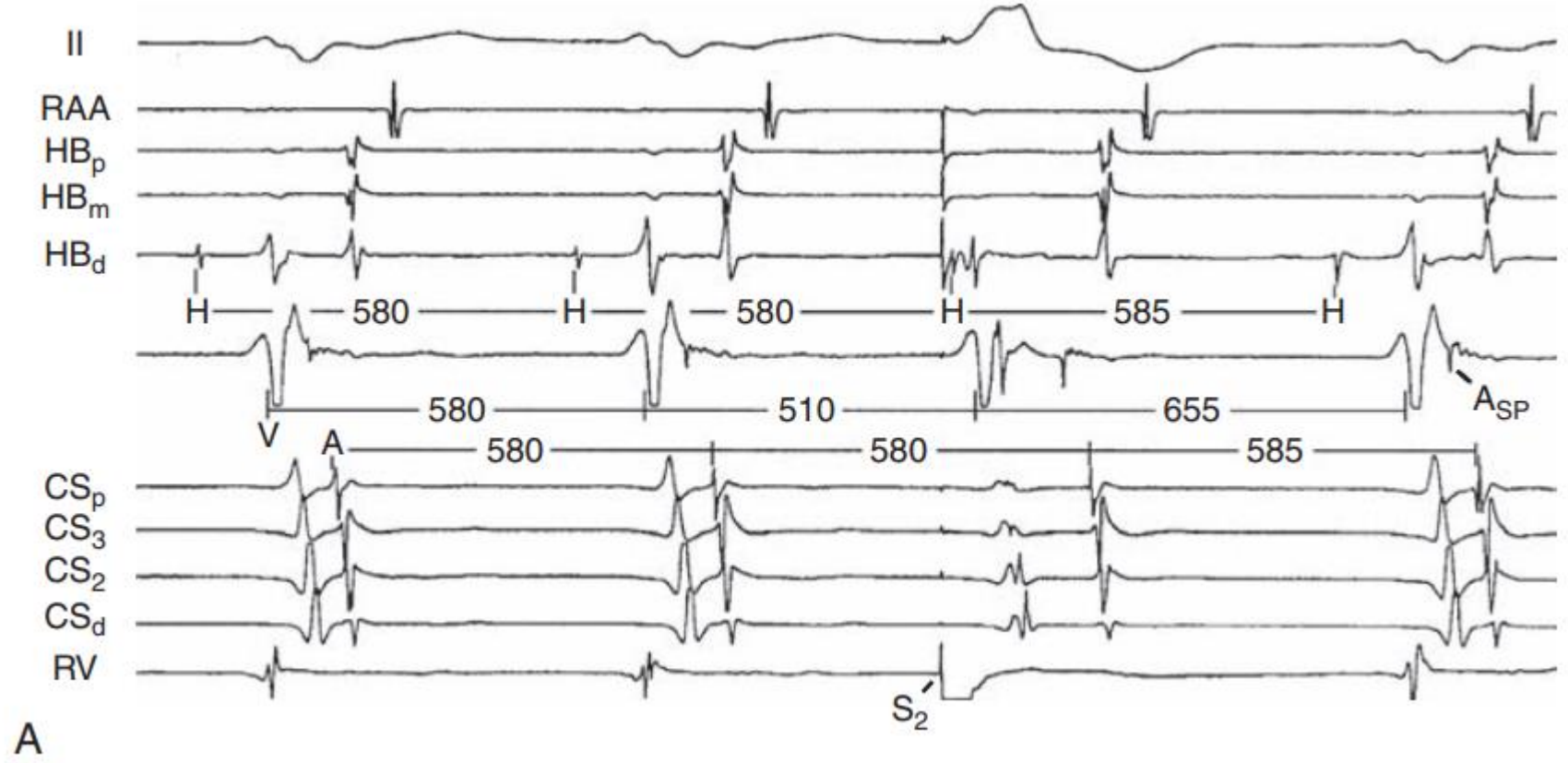
AVNRT vs. AVRT

Ventricular pacing

- The extrastimuli induce an advance in the timing of atrial activation without first retrogradely activating the His bundle. This means the presence of an accessory AV pathway.
- Conversely, an accessory AV pathway is unlikely to be present if the timing and sequence of retrograde atrial activation are unchanged by a ventricular extrastimulus.

AVNRT vs. AVRT

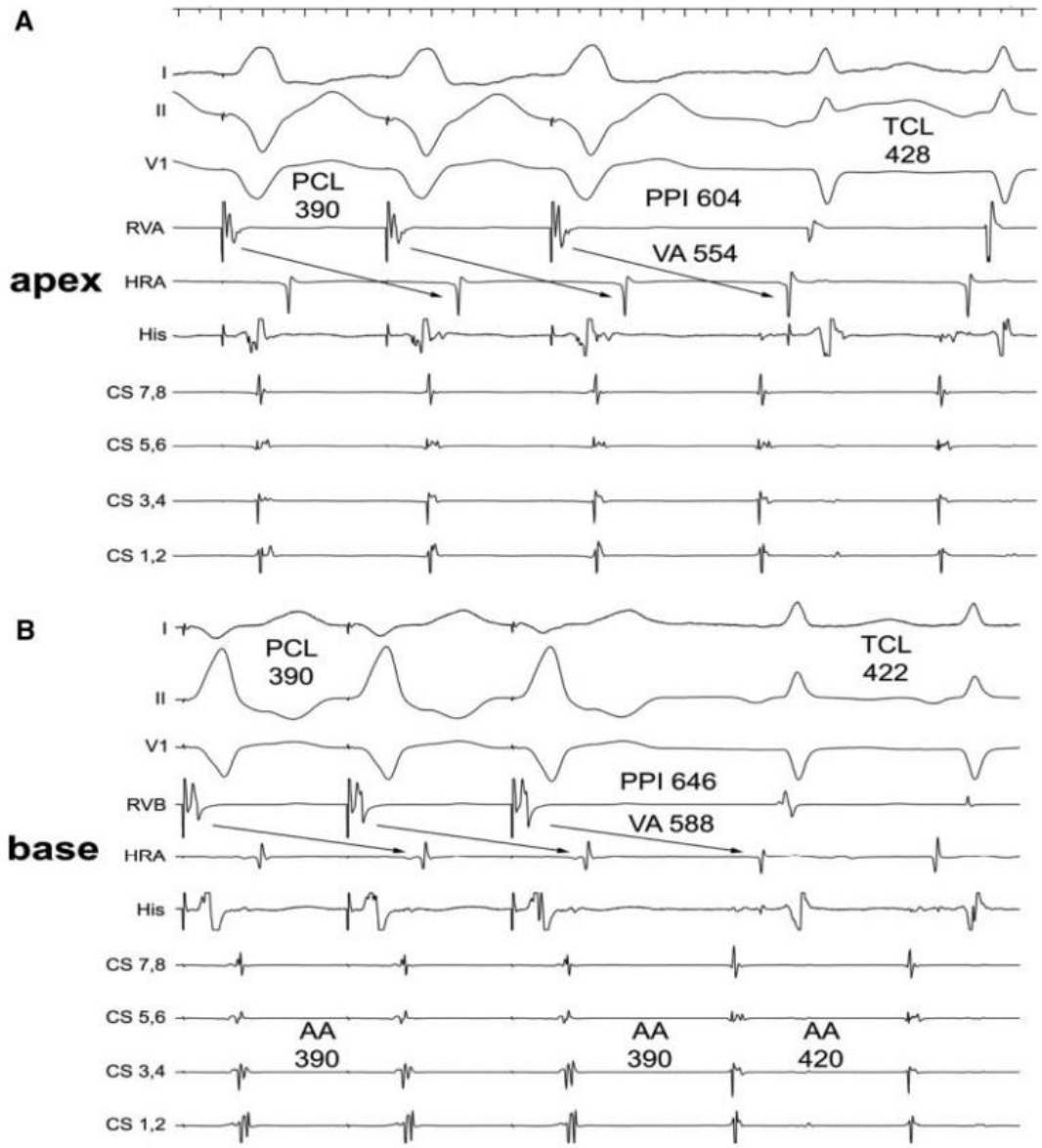
S2 did not advance the timing of His bundle activation (H) or atrial activation, excluding retrograde conduction over an accessory pathway and AVRT.



Lockwood D, Jackman WM, et al. Zipes and Jalife's Cardiac Electrophysiology: From Cell to Bedside 8e 2022.

AVNRT vs. AVRT

Differential entrainment from the apex or the basal area of the RV:
A differential (between base and apex) corrected PPI-TCL >30 ms or a differential VA interval >20 ms predicted AVNRT.



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AVNRT vs. AVRT

HA interval

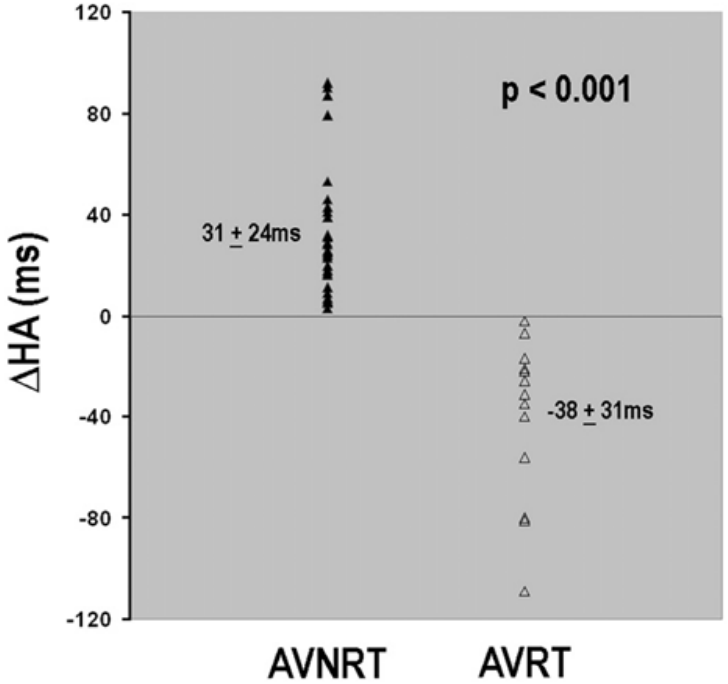
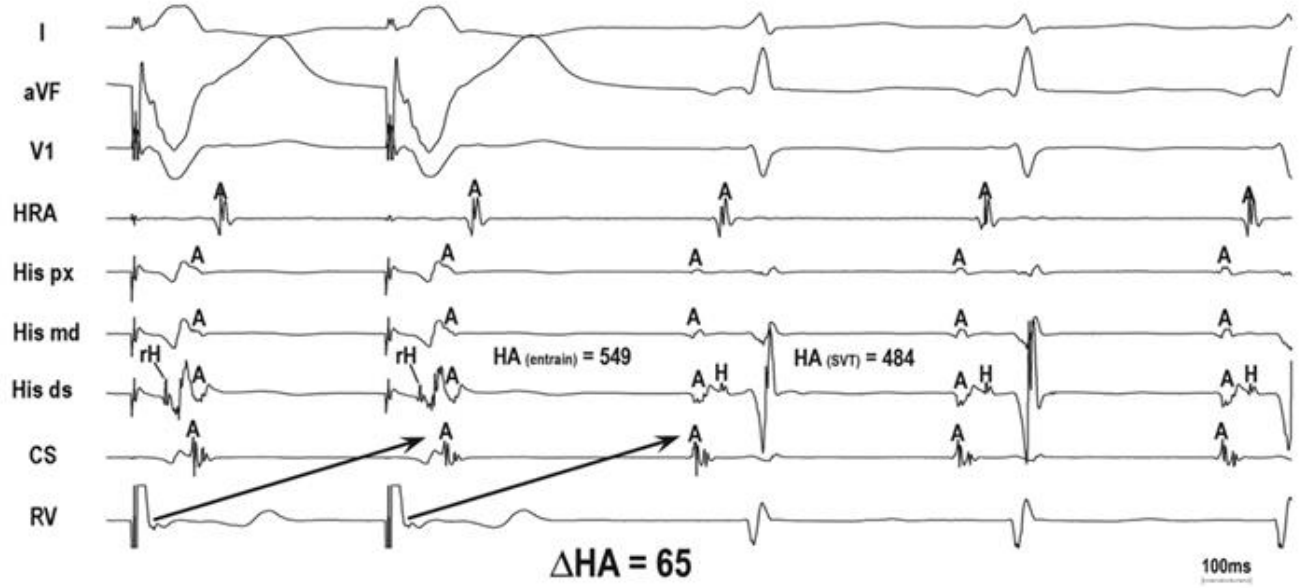
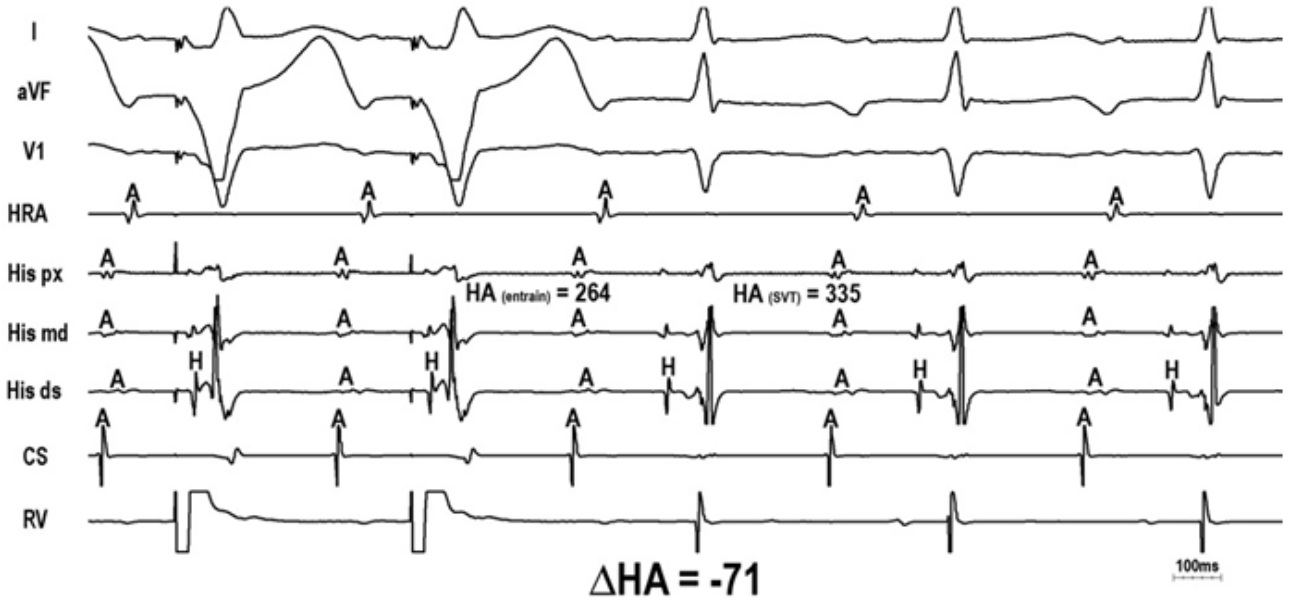


Figure 2 ΔHA values for atrioventricular nodal reentrant tachycardia (AVNRT) and atrioventricular reentrant tachycardia (AVRT). All ΔHA values were positive for AVNRT and negative for AVRT.





HeartRhythm2008;5:83–88.

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Catheter ablation

- Initial target: retrograde slow pathway in the tachycardia circuit.
- Followed by ablation of anterograde slow pathway conduction, if present.
- RF energy is delivered to the sit of earliest retrograde atrial activation
- Usually, the region between the inferoseptal tricuspid annulus and CS ostium.
- Recurrence rate: 1-2%.

Targets (the earliest site of atrial activation)

Table 1. Electrocardiographic and electrophysiologic characteristics of atypical AVNRT using variants of slow pathway extending along the tricuspid annulus.

Subtype	Earliest site of atrial activation	P-QRS relationship (AH/HA ratio)
Atypical AVNRT using a superior or superoanterior slow pathway		
Fast-slow	Non coronary sinus of Valsalva	Long RP (<1), rarely short RP (>1)
Slow-slow	Perihisian region	Short RP (>1) is common
	Superior or superoanterior right atrium along the tricuspid annulus	
Atypical AVNRT using an inferolateral slow pathway		
Fast-slow	Inferior or inferolateral right atrium along the tricuspid annulus	Long RP (<1)

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Targets

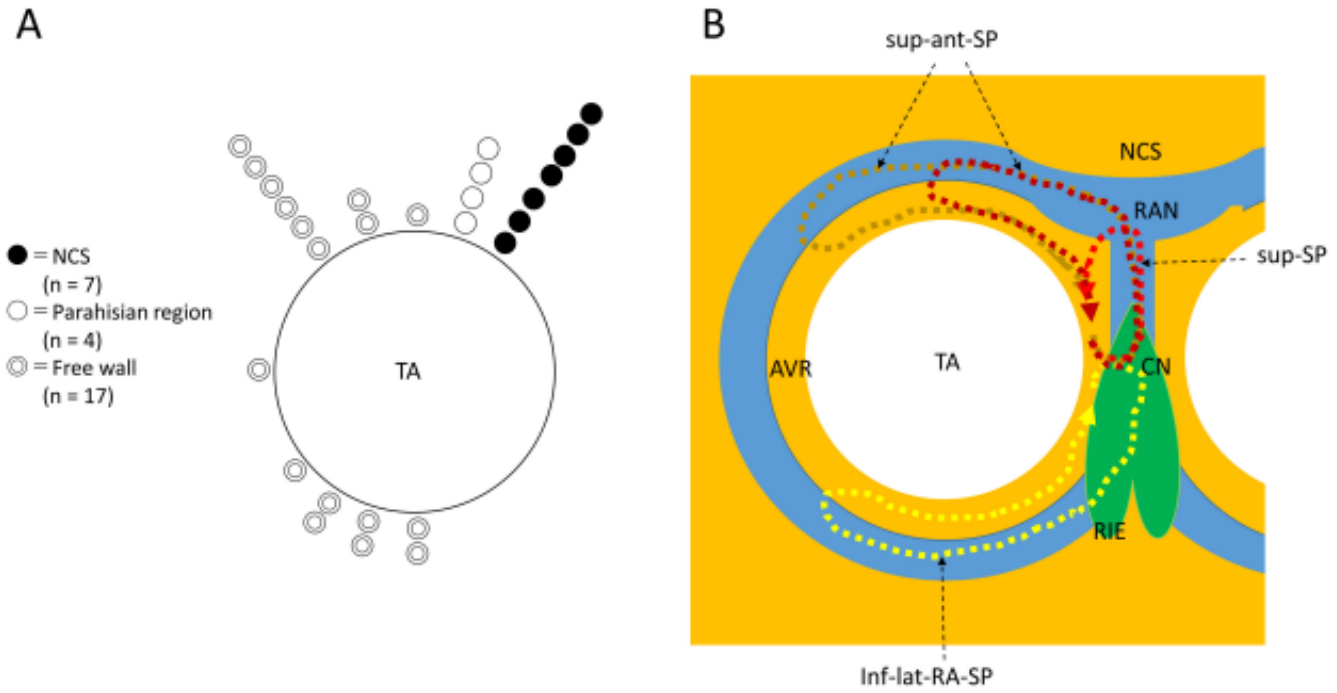
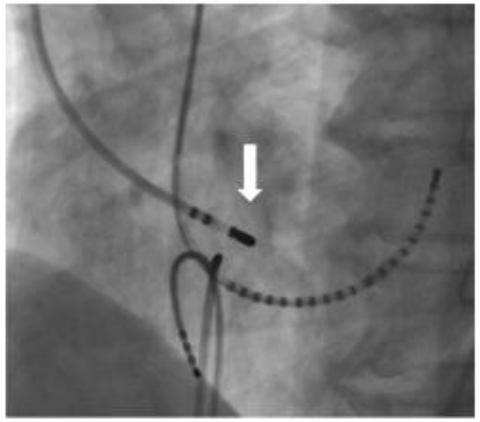
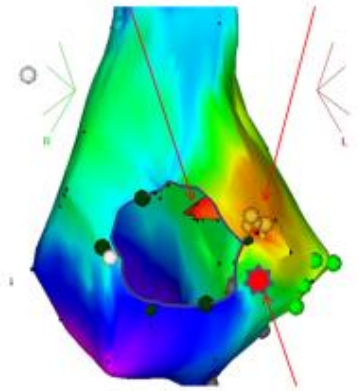


Fig. 1. Distribution of the site of earliest atrial activation during fast-slow AVNRT using a superior, superoanterior or inferolateral right atrial SP (A) and schematic illustration of the reentry circuits of an atypical fast-slow AVNRT using variants of SP, the AV ring (AVR) and the retroaortic node (RAN) (B).

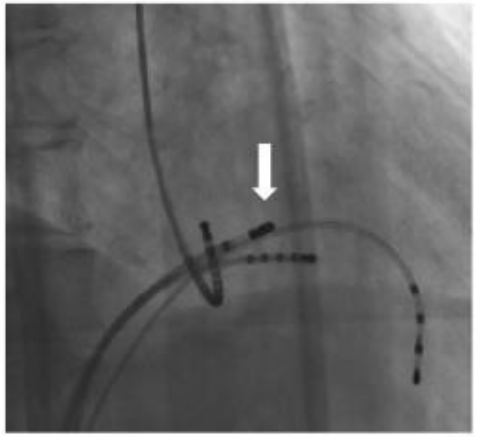
Ablation: superior-type of fast/slow AVNRT

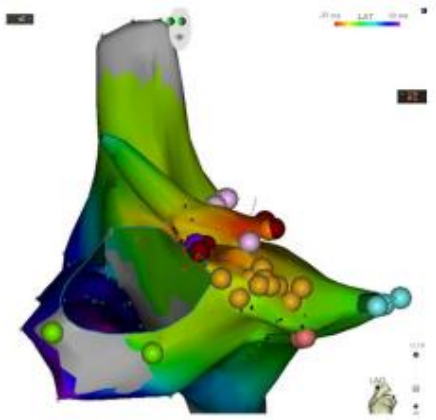
A Non-coronary cusp





B Right perihisian region





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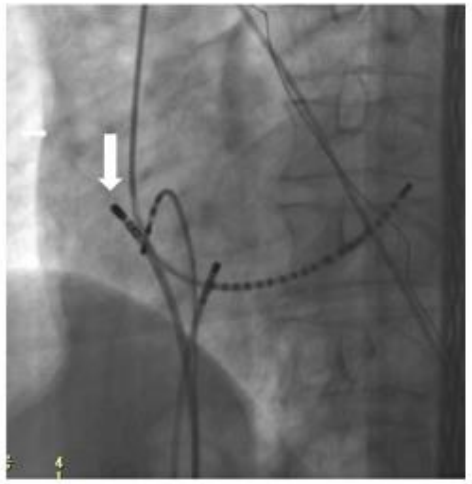
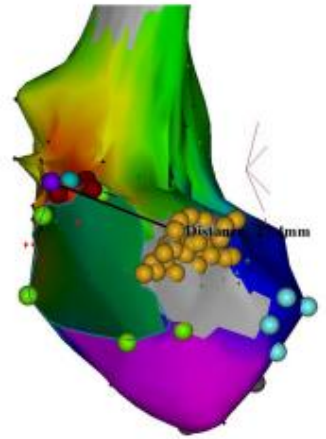
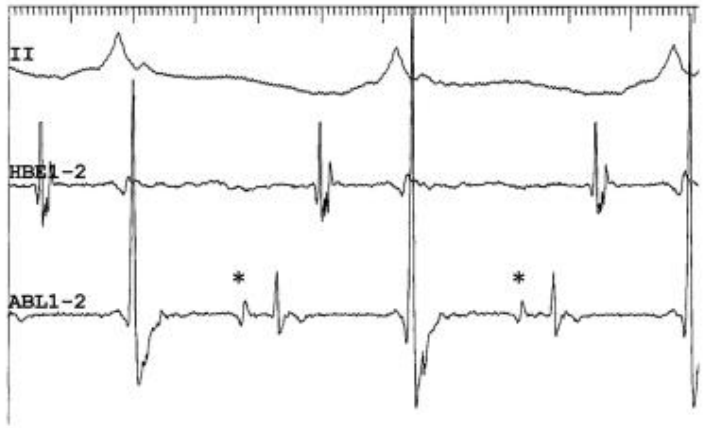
Ablation

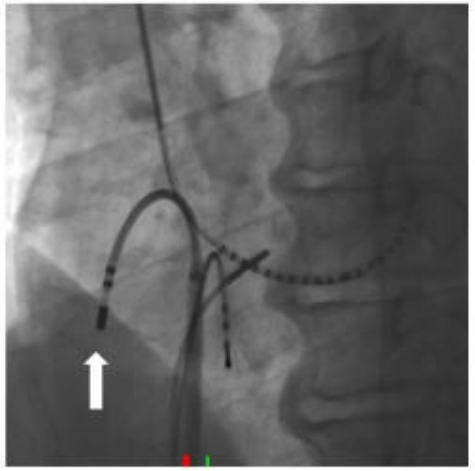
C Superoanterior type

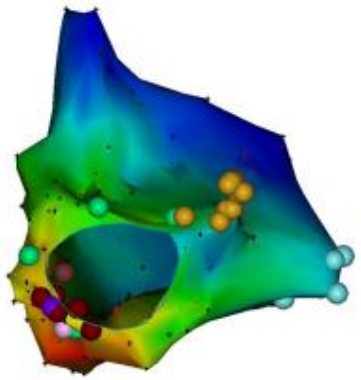




D Interolateral type







Rev. Cardiovasc. Med. 2022；23(11): 369

Catheter ablation

Endpoints for Successful Slow Pathway Catheter Ablation in Typical and Atypical Atrioventricular Nodal Re-Entrant Tachycardia

A Contemporary, Multicenter Study

Demosthenes G. Katritsis, MD, PhD,[a] Theodoros Zografos, MD,[a] Konstantinos C. Siontis, MD,[b] George Giannopoulos, MD,[c] Rahul G. Muthalaly, MD,[d] Qiang Liu, MD,[e] Rakesh Latchamsetty, MD,[b] Zoltán Varga, MD,[f] Spyridon Deftereos, MD,[c] Charles Swerdlow, MD,[e] David J. Callans, MD,[f] John M. Miller, MD,[g] Fred Morady, MD,[b] Roy M. John, MD,[d] William G. Stevenson, MD[d]

- Junctional rhythm during radiofrequency current delivery is a sensitive but not a specific marker of ablation success. It is useful, however, to indicate potential non-inducibility.
- The presence of residual post-ablation AV nodal dual pathway physiology is not a marker of recurrence. Prolonged procedures aimed at eliminating residual AV nodal duality are unnecessary and potentially harmful by increasing radiation times and, perhaps, the risk of ablation-induced AV block.
- Abolition of AVNRT inducibility in the presence of isoproterenol challenge is the most reliable marker for ablation success.

J Am Coll Cardiol EP 2019;5:113–9.