How to Differentiate VT or SVT

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SVT that mimics VT

- SVT with aberration
- AVNRT with bystander AP
  - Very short VA interval
- Antidromic AVRT
  - PAC advances or terminated the tachycardia
  - PAC delays the tachycardia (atriovascularicular pathway)
Baseline Observation during NSR

- BBB
- Preexcitation
HV interval

• Positive HV interval
  • $HV_{WCT} < HV_{NSR}$ : VT or preexcited SVT
  • $HV_{WCT} \geq HV_{NSR}$ : SVT with aberrancy, BBR VT

• Negative HV interval
  • BBR VT and SVT with aberrancy are excluded
  • Myocardial VT and preexcited SVT generally have neg HV

• Prolongation of TCL with transient RBBB (due to catheter manipulation)
  • Diagnostic of antidromic AVRT using right-sided BT
  • Excludes preexcited AVNRT
  • Excludes BBR VT (it will be terminated)
Oscillation in the TCL

• Variations in the TCL (V-V interval) that are preceded by similar variations in the A-A or H-H intervals are suggestive of SVT with aberrancy or BBR VT

• Variations in the V-V intervals that predict the subsequent H-H interval changes are consistent with VT or preexcited SVT
EGM stored by the ICD during an episode of tachycardia with 1:1 AV relationship

TCL variations (V-V intervals) are preceded by A-A intervals, which is consistent with SVT rather than VT
AV relationship

- 1:1 AV relationship can occur in both VT and SVT
- A > V
  - VT is unlikely, except in the rare case of coexistent AT and VT
- V > A
  - VT is more likely, except for the rare case of JT or AVNRT with VA block in an upper common pathway
Atrial activation sequence

- A concentric atrial activation sequence can occur in SVT and VT
- An eccentric atrial activation sequence practically excludes VT
Effect of adenosine

• Termination of WCT with adenosine can occur in SVT and adenosine-sensitive VT
• AV block with continuation of the WCT can occur in aberrantly conducted AFL, AF, or AT
Diagnostic Maneuver

• Atrial extra-stimulation
  • AES advancing/delaying the next V activation with similar QRS morphology to the WCT excludes VT

• With a late-coupled AES delivered when AV junctional portion of the atrium is refractory
  • If the AES advances the next V activation => excludes VT
  • If the AES advances both the next V and the subsequent A activation => excludes preexcited AVNRT
AES during tachycardia

Late-coupled AES delivered when the AV junction is refractory resets both the next V and the subsequent A activation

How can we know that the AV junction is refractory?
- Lack of advancement of timing of the local A EGM recorded by His bundle catheter

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AES during tachycardia

Late-coupled AES delivered when the AV junction is refractory advances subsequent QRS and terminated SVT

Retrograde block in the His-Purkinje system to AV node

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AES during tachycardia

Earlier AES terminates the SVT without conduction to the V (anterograde block in the BT)

The AES advances the timing of AV junctional atrial activation

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• Late-coupled AES resets both the next V and the subsequent A activation
• Late-coupled AES advances subsequent QRS and terminated SVT
• Earlier AES terminates the SVT without conduction to the V

Antidromic AVRT
AES during tachycardia
AES during tachycardia

Late-coupled AES delivered when the AV junction is refractory

delayed subsequent QRS

Atriofascicular antidromic tachycardia
Atrial Pacing (Entrainment)

• Atrial entrainment of the WCT with similar QRS morphology to that of the WCT (concealed fusion)
  • excludes myocardial VT
  • occurs in BBR VT and SVT

• Atrial entrainment of the WCT with manifest QRS fusion
  • Occurs in VT with bystander BT, or in AVRT with multiple BTs
  • Excludes antidromic AVRT with single BT, or SVT with aberrancy
Atrial Pacing

• When rapid atrial pacing dissociates the atrium without influencing the TCL or QRS morphology
  • It suggests VT
  • It excludes preexcited SVTs, AT with aberrancy, orthodromic AVRT with aberrancy
  • It dose not exclude the rare case of AVNRT with aberrancy associated with anterograde block in an upper common pathway
Atrial overdrive pacing at a CL 20 to 60ms shorter than the TCL with 1:1 AV conduction

- V-V-A response: VT
- V-A response: antidromic AVRT, SVT with aberrancy

Be sure that 1:1 AV conduction is present

- Isorhythmic AV dissociation can mimic 1:1 AV conduction, especially when the pacing train is not long enough or the pacing CL is too slow
Pseudo V-V-A response

Due to anterograde conduction over the slow AVN pathway

Careful examination of pacing CL and return CL helps avoid this potential pitfall

Atypical AVNRT with LBBB

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Ventricular Extrastimulation

• A VES that resets (advances or delays) the next QRS without affecting the A-A interval
  • Consistent with VT
  • Excludes SVT

• A VES that terminates the WCT without conduction to the atrium
  • Excludes AT and AVRT
  • Consistent with VT, but can also occur in AVNRT
Ventricular Pacing

• When overdrive ventricular pacing fails to accelerate the atrial CL to the pacing CL (i.e. the ventricles are dissociated from the tachycardia)
  • VT and AVRT are excluded
  • AT is the most likely diagnosis
  • But AVNRT is still possible
ATP failed to terminate the tachycardia

The ventricle is dissociated from the tachycardia

1:1 AV relationship is demonstrated in the intracardiac EGM stored by the ICD

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ATP failed to terminate the tachycardia

Atrial rate continues unperturbed during ramp ATP

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Ventricular Pacing (Entrainment)

• Entrainment with manifest QRS fusion
  • Can occur in VT or AVRT
  • Excludes AT and AVNRT (They cannot be entrained)

• Entrainment from the RV apex followed by short PPI (within 30ms to the TCL)
  • Excludes AT, AVNRT, myocardial VT
  • Can occurs with BBT VT and AVRT using a right-sided BT
Summary

• Baseline EPS findings to differentiate SVT from VT include HV intervals, oscillation in the TCL, AV relationship, atrial activation sequence, and effects of adenosine.

• If AES resets or terminates the tachycardia, it suggests antidromic reentrant tachycardia.

• Atrial entrainment with concealed QRS fusion suggests antidromic reentrant tachycardia.

• When rapid atrial pacing dissociates the atrium without influencing the TCL or QRS morphology, it suggests VT.