



A conference that is for us and by us

# 'If You Ain't First, You're Last': Adenosine Vs. Calcium Channel Blockers for Supraventricular Tachycardia (SVT)

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# Disclosure

I have no actual or potential conflicts of interest in relation this presentation

# Objectives



Review current guideline recommendations for the treatment of paroxysmal supraventricular tachycardia (pSVT)

Recognize why adenosine may no longer be the only first-line pharmacologic therapy

Appraise the current available evidence for calcium channel blockers (CCB) in pSVT

Discuss scenarios when *not* to use either agent

# SVT: Umbrella Term



- Quite literally translates to “above the ventricles”
  - Refers to any arrhythmia with its origin above the bundle of His
- For the rest of the presentation SVT or paroxysmal SVT (pSVT) will be intended as AVNRT

# SVT: Epidemiology



3 per 1,000  
adults



36 per 100,000  
people annually



2:1  
Female to male



# SVT: Pathophysiology

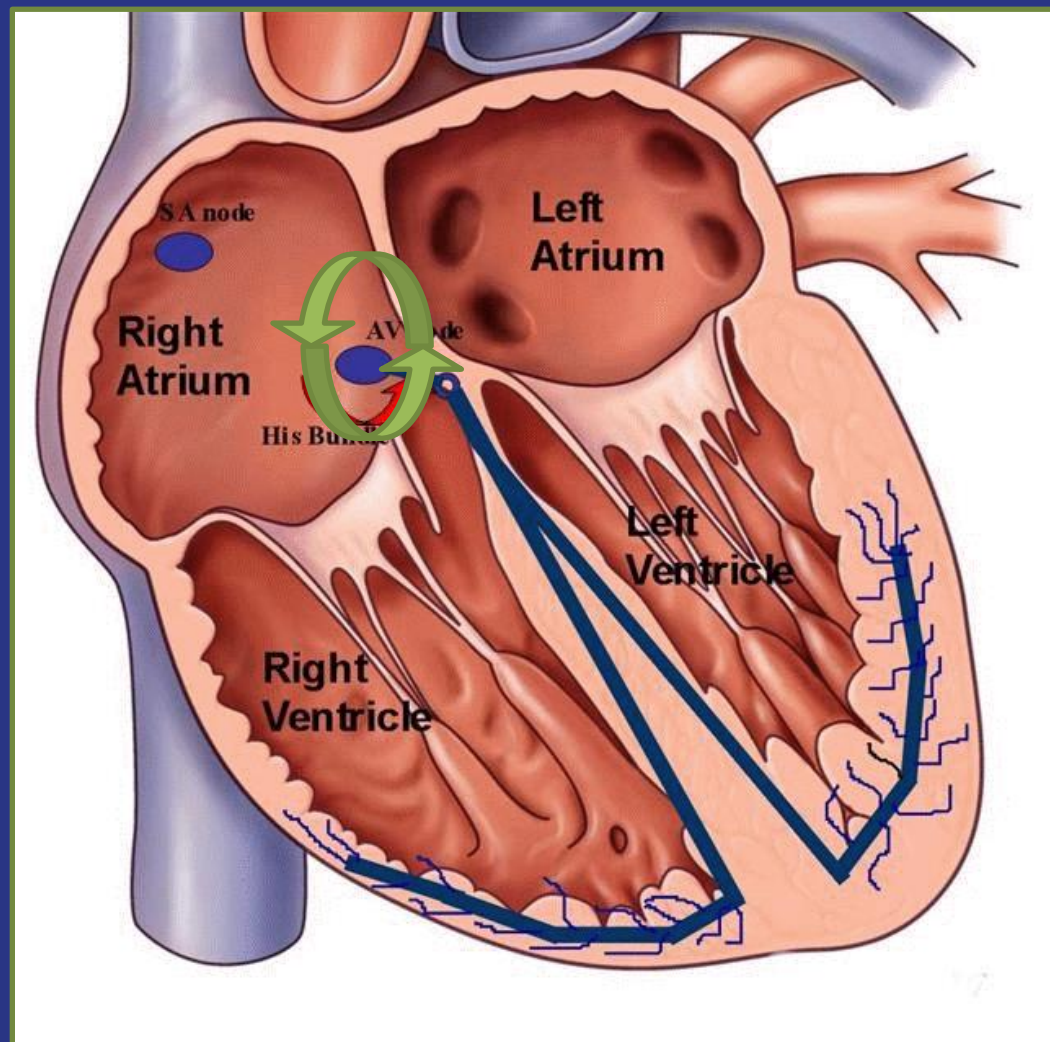


Image courtesy of washingtonhra.com

- Spontaneous or triggered (e.g. physical or emotional stress, caffeine, hypothyroidism, etc.)

Fast and slow pathways within the AV nodal tissue



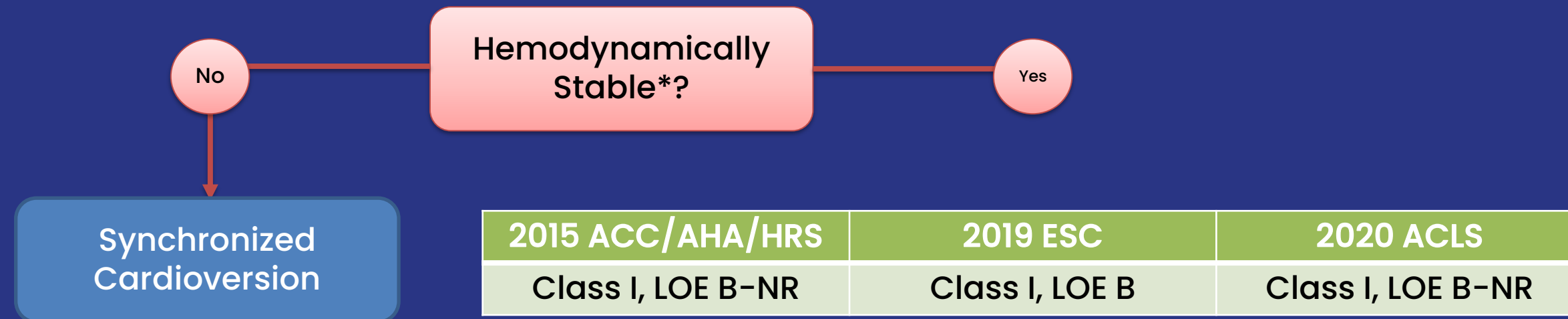
Normal ventricular conduction



Narrow complex tachycardia

GOAL: Block or slow conduction through the AV node

# Guideline Recs – Unstable



## \*How is that defined?

- Ischemic chest pain
- Altered mental status
- Shock
- Hypotension
- Acute heart failure

# Guideline Recs – Stable

Hemodynamically  
Stable

Yes

Vagal Maneuvers

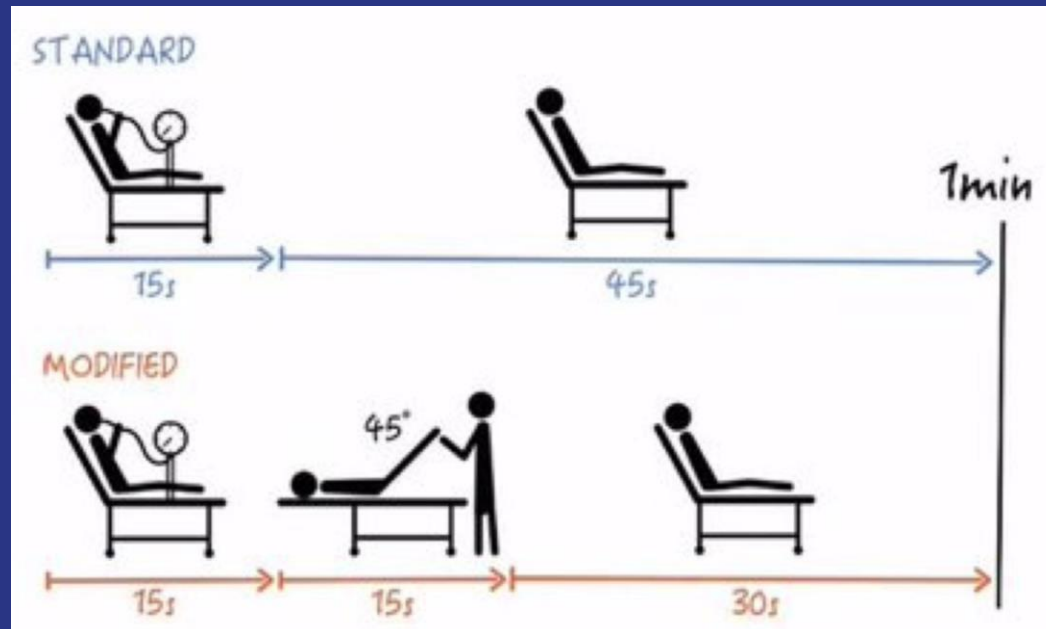


Image courtesy of medmastery.com

2015 ACC/AHA/HRS

Class I, LOE B-R

2019 ESC

Class I, LOE B

2020 ACLS

Class I, LOE B-R

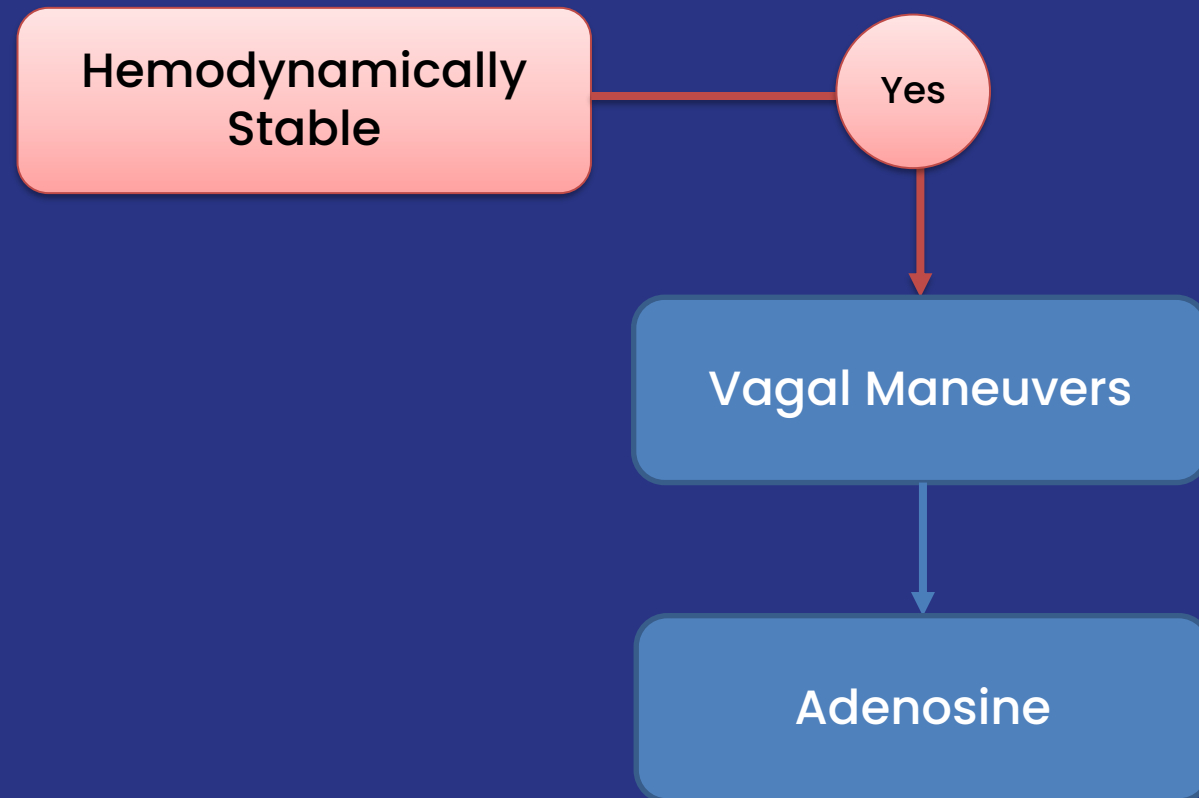
## 2015 – REVERT Trial

Modified Valsalva technique vs. standard  
Return to NSR in 1 min: 43% vs 17% (NNT 3)

Adenosine use ↓ 28%  
0 serious adverse events  
Simple, safe and free



# Guideline Recs – Stable



2015 ACC/AHA/HRS	2019 ESC	2020 ACLS
Class I, LOE B-R	Class I, LOE B	Class I, LOE B-R

# Adenosine

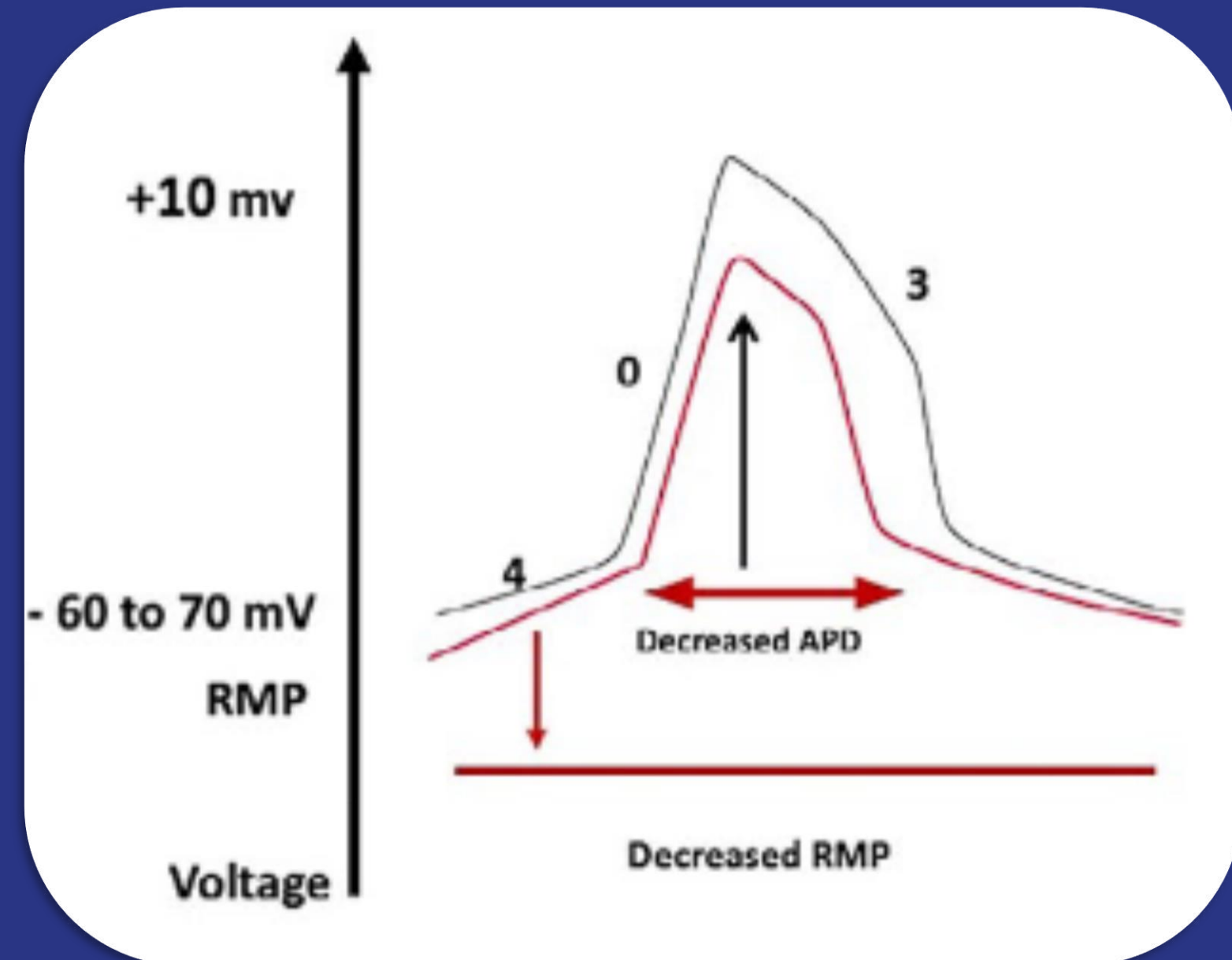
# Pharmacology

<b>Onset</b>	20–30 seconds
<b>Metabolism</b>	Phosphorylation Deamination within RBCs
<b>Half-life</b>	<10 seconds

## Common Dosing Scheme

**Initial dose: 6 mg → 12 mg x 2**

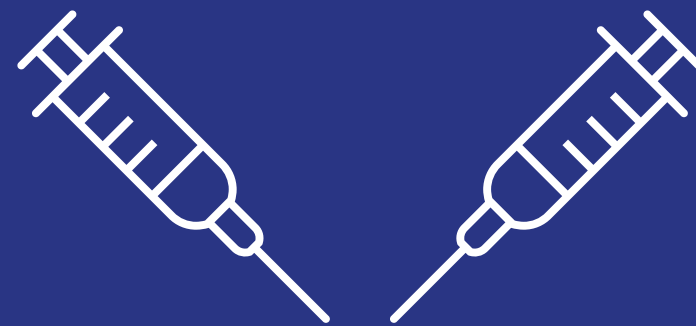
<b>Special Considerations to ↓ 3 mg :</b>	Heart transplant recipients Central venous access Dipyridamole
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# Adenosine Pitfalls



↓ efficacy with recent  
caffeine ingestion



Difficult administration



Single syringe  
technique



Caution in reactive  
airway disease

# *[Not so]* Minor Side Effects

- Dyspnea
- Chest tightness
- Headache
- Facial flushing
- Nausea

Related to vasodilatory properties



Feeling of  
“impending doom”

“Felt like I was going to die.”

“Worst experience of my life!”

# Comprehension Question

## Case:

CC is a 33-year-old male who presents to the ED with complaints of palpitations and shortness of breath since yesterday morning.

CC reports having “SVT” in the past.

12-lead ECG today shows a regular, narrow complex tachycardia with a rate of 216 BPM.



# Comprehension Question 1

The EM intern is asking for pharmacy assistance with adenosine administration for CC, after vagal maneuvers were attempted and failed.

She is reviewing the case with you, what are some things to review before administering:

- A. How were vagal maneuvers performed?
- B. PMH for severe reactive airway disease
- C. Prior therapies for AVNRT and patient comfort
- D. Assess vital signs for hemodynamic stability
- E. All of the above

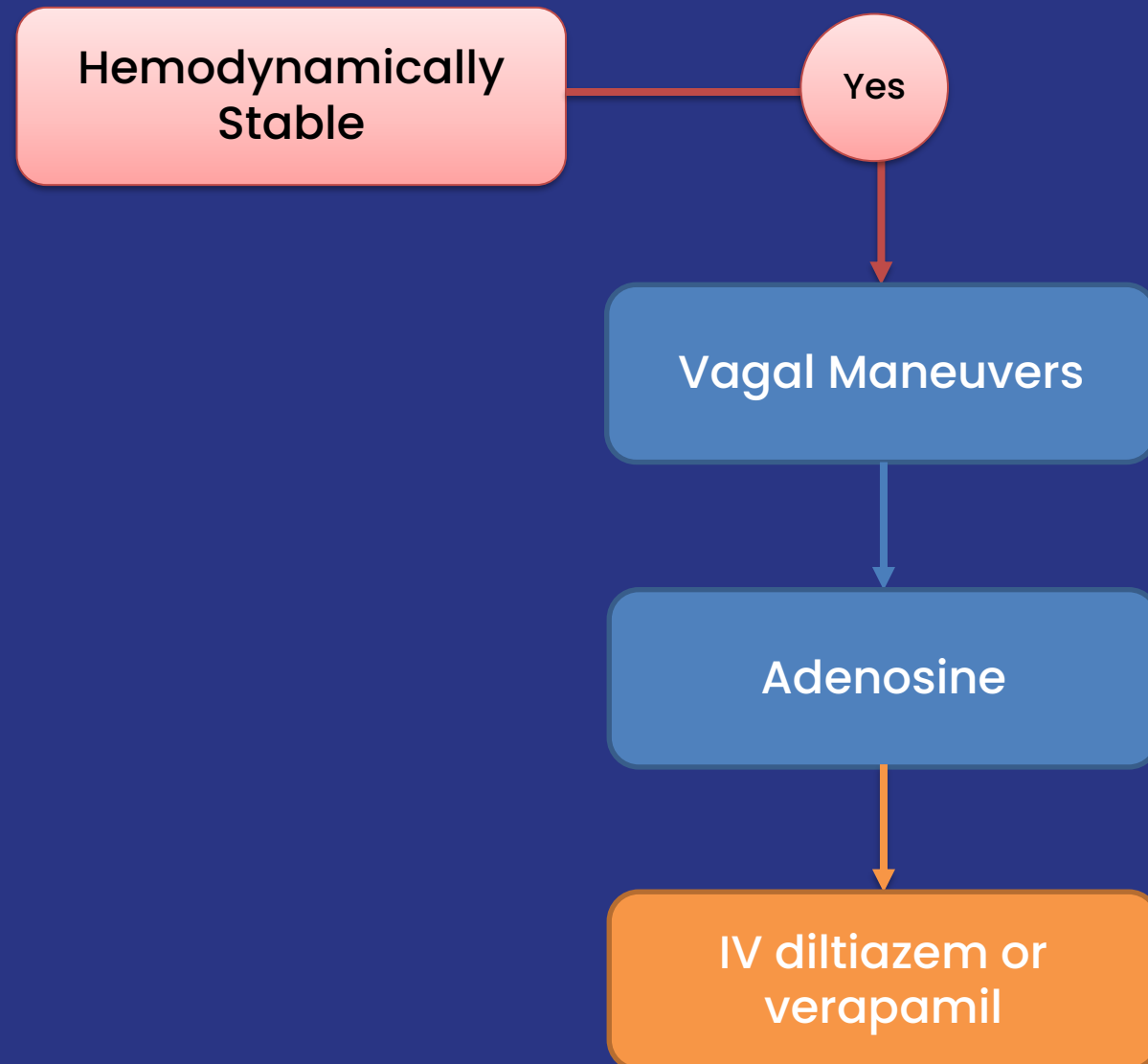
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- E. **All of the above**

# Guideline Recs – Stable



2015 ACC/AHA/HRS	2019 ESC	2020 ACLS
Class IIa, LOE B-R	Class IIa , LOE B	Class IIa, LOE B-R

# Calcium Channel Blockade

## Non-dihydropyridine

- ↑ cardioselectivity vs DHP CCB

	Verapamil	Diltiazem
<b>Onset</b>	< 5 minutes	< 5 minutes
<b>Duration</b>	≤ 6 hours	1-3 hours
<b>Doses</b>	2.5-5 mg over 2 min ➤ 5-10 mg q15-30 min [Max: 30 mg] -or- 1 mg/min infusion until NSR or 20 mg	0.25 mg/kg over 2 min ➤ 0.35 mg/kg in 15 min -or- 2.5 mg/min infusion until NSR or 50 mg

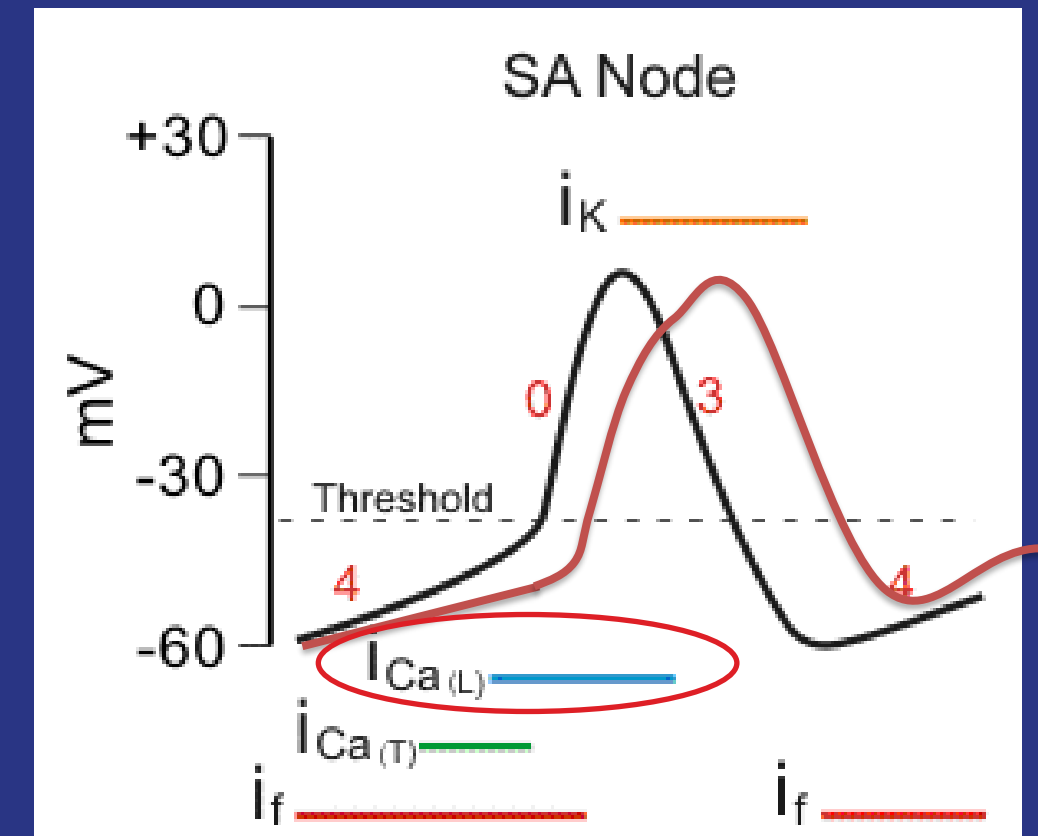


Image courtesy of cvpharmacology.com



# **PowerRx** conference

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# Head To Head

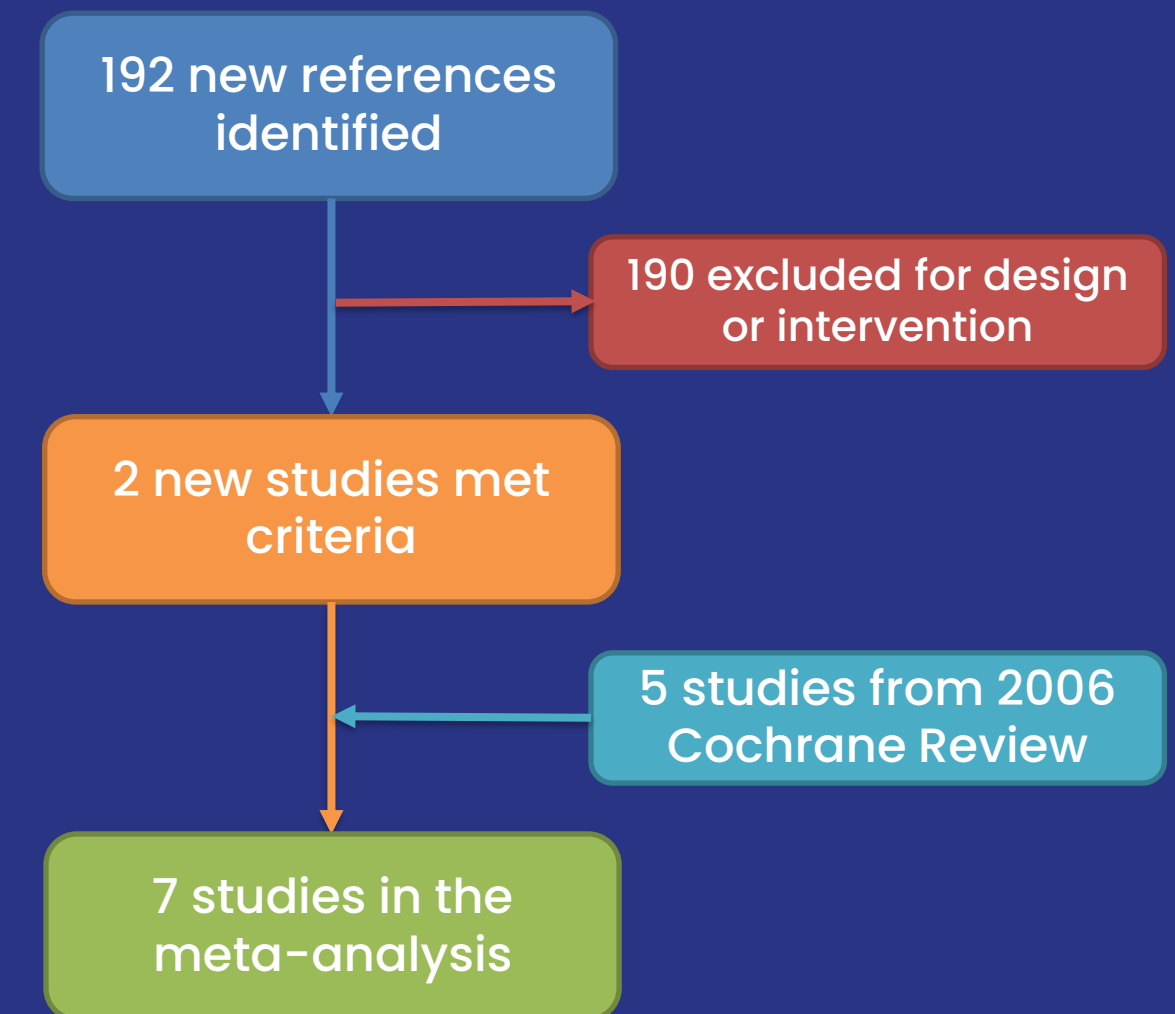


Image courtesy of [pressreader.com](http://pressreader.com)



# 2017 Cochrane Review

Criteria for studies utilized in the review	
<b>Patients included</b>	Any age Within 24 hours of onset Diagnosis via 12-lead ECG
<b>Patients excluded</b>	SVT induced in the electrophysiology lab
<b>Methodology</b>	RCTs only (-) <i>Publications that were reviews, retrospective, of observational design or not randomized were excluded</i>
<b>Interventions included</b>	Any direct comparison of IV CCBs versus IV adenosine Any dose or infusion rate of either



# 2017 Cochrane Review

## Primary Outcomes

1. Reversion to sinus rhythm
2. Major adverse events

All 7 studies reported  
N = 622  
89.7% with adenosine vs. 92.9% with CCBs  
OR 1.51 (95% CI [0.85–2.68])

## Secondary Outcomes

1. Time to NSR
2. Rate of relapse within 2 hr
3. Length of stay
4. Minor adverse events
5. Patient satisfaction

No difference in efficacy

# 2017 Cochrane Review

## Primary Outcomes

1. Reversion to sinus rhythm
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## Secondary Outcomes

1. Time to NSR
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3. Length of stay
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5. Patient satisfaction

Only 3 studies reported  
N = 306

Hypotension within 2 hours post-infusion  
0 events with adenosine vs. 1 with CCBs  
OR 3.09 (95% CI [0.12–76.71])

Low-quality of evidence

Note: 2 of 3 trials reporting, specifically excluded patients with SBP <90 mmHg at enrollment

# 2017 Cochrane Review

## Primary Outcomes

1. Reversion to sinus rhythm
2. Major adverse events

## Secondary Outcomes

1. Time to NSR
2. Rate of relapse within 2 hr
3. Length of stay
4. Minor adverse events
5. Patient satisfaction

4 studies reported  
N = 358  
3.3% with adenosine vs. 1.14% with CCBs  
OR 0.38 (95% CI [0.09-1.69])

# 2017 Cochrane Review

## Primary Outcomes

1. Reversion to sinus rhythm
2. Major adverse events

## Secondary Outcomes

1. Time to NSR
2. Rate of relapse within 2 hr
3. Length of stay
4. Minor adverse events
5. Patient satisfaction

## Heterogenous data overall

3 studies reported on chest tightness

- N = 222
- 11.7% vs. 0%; OR 0.09 (95% CI [0.02, 0.50])

2 studies reported on shortness of breath

- N = 171
- 6.9% vs 1.2%; OR 0.23 (95% CI [0.04–1.37])

1 study reported on flushing

- N = 50
- 61.5% vs 0%; OR 0.01 (95% CI [0.00–0.24])



# CCBs: Slow infusion

206 patients with spontaneous SVT were prospectively randomized to:

## Adenosine (n=102)

- 6 mg followed by 10 mL saline IVP → 12 mg repeat within 2 min

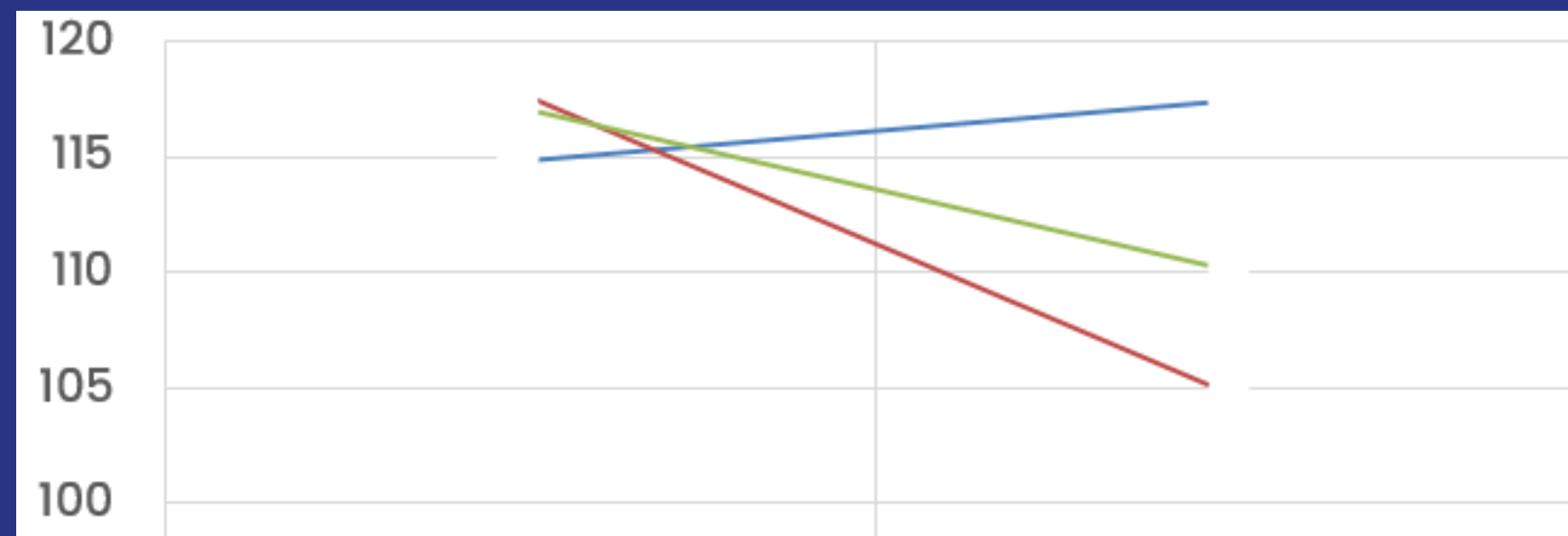
## CCBs via slow infusion

- Verapamil (n=48)
  - 1 mg/min up to 20 mg
- Diltiazem (n=54)
  - 2.5 mg/min up to 50 mg

If SVT not converted by end of infusions, patients were crossed-over to opposite group\*

Results	
Success rate	98% with either CCB vs. 86.5% with adenosine RR 1.13 (95% CI 1.04–1.23); p=0.002
Dose to convert ≥75% patients	7.7 mg verapamil or 18.1 mg diltiazem
Time to conversion:	6.5–6.76 min with CCB vs 1.48 min Adenosine

# CCBs: Slow infusion



- Hypotension (SBP  $\leq 90$  mmHg)
  - 1 pt in the CCB (0.98%) vs 0 pts in adenosine group (95% CI 0.025–5.3)

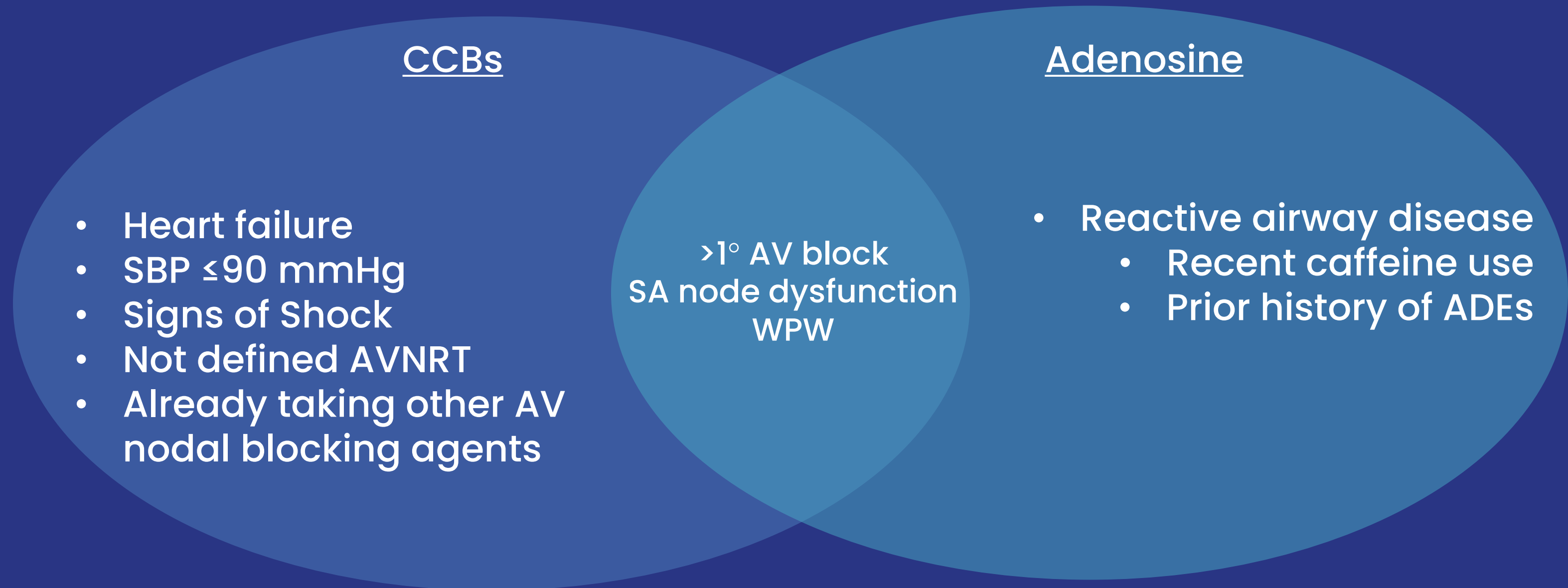
Slow infusion may mitigate risk of developing hypotension

	Baseline SBP (mmHg)	SBP post-conversion (mmhg)
Adenosine	114.8	117.4
Verapamil	117.7	104.7
Diltiazem	117.1	110.1

# 2021 Diltiazem Bolus

Disclaimer	Poster presentation from 2021 AHA annual conference
Methods	Prospective, randomized Hemodynamically stable SVT, who failed vagal maneuvers
Intervention	Diltiazem IV bolus 0.25 mg/kg → 0.35 mg/kg if no conversion
Control	Adenosine 6 mg → 12 mg if no conversion
<i>All Groups</i>	Followed by a continuous infusion of diltiazem if no conversion
Results	N = 52 Conversion to NSR: 26/26 (100%) vs 20/26 (76.9%) [p=0.023] Mean Δ in BP was not-significantly different No significant Δ in adverse events

# When to Avoid



# Intra-nasal, in-to-our Future?



## Etripamil

- Novel non-DHP CCB administered as a nasal spray
- Absorption within 10 minutes

### Phase II Trial – NODE-1

Methods	<ul style="list-style-type: none"><li>• Induced SVT in patients undergoing catheter ablation</li><li>• Placebo-controlled</li></ul>
Results	<ul style="list-style-type: none"><li>• <b>Conversion rates:</b> 65–95% (dose-dependent)</li><li>• Time to conversion &lt;3 minutes</li><li>• Drop in BP only seen with highest dose</li><li>• Side effects: local nasal irritation</li></ul>



# Case Continued

You and the team ask why the patient waited so long to come in, especially if they've had SVT before, and CC says, "I just afraid to come in, the meds messed me up real good last time!"

Most recent vital signs still with a HR of 216 BPM, and BP 126/79 mm Hg.

Reviewing PMH with CC and the intern, you discover he has asthma and with his trouble breathing CC has been continuously using his albuterol inhaler, but no wheezing noted on exam by the intern.

# Comprehension Question 2

What pharmacologic or non-pharmacologic therapy would you recommend with this new information?

- A. Synchronized cardioversion
- B. Adenosine 6 mg rapid IVP, followed by 20 mL saline flush
- C. Adenosine 6 mg and saline in a single syringe, given as rapid IVP
- D. Diltiazem 0.25 mg/kg IVP over 2 minutes or as slow infusion at 2.5 mg/min up to 50 mg

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# Comprehension Question 3

Select all that apply. What are reasons to avoid CCBs for the treatment of pSVT.

- A. Presenting on/already receiving beta-blockers or non-DHP CCBs
- B. Patients with robust blood pressure and hemodynamically stable
- C. Heart failure with reduced ejection fraction ( $\leq 40\%$ )
- D. Poor, prior patient experiences with adenosine

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# Take-Home Points

- ❑ Guideline recommendations still maintain Adenosine as 1<sup>st</sup> line
- ❑ Non-DHP CCBs, vs. adenosine, are:
  - ❑ Equally efficacious
  - ❑ Unlikely to cause hypotension
  - ❑ Associated with fewer 'minor' adverse events
- ❑ The devil is in the details
  - ❑ Patient selection & preference is key for CCBs
  - ❑ **CAUTION** with signs of shock, hypotension or heart failure





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