

## Calcium Channel Blockers (CCBs) vs Adenosine for Supraventricular Tachycardia (SVT)

### Introduction

- SVT indicates narrow complex tachycardia with atrial rates >100 beats per minute
- Dysrhythmias meeting SVT criteria include atrial tachycardia, atrioventricular (AV) junctional tachycardia and AV reentrant tachycardia
- Immediate direct-current cardioversion is indicated in hemodynamically unstable patients
- Non-cardioversion options available for hemodynamically stable patients in SVT of unknown etiology
  - First-line: vagal maneuvers → alsalva maneuver or carotid sinus massage
  - Second-line: adenosine, IV non-dihydropyridine calcium channel blockers (i.e. diltiazem or verapamil) and IV beta-blockers (i.e. esmolol or metoprolol)

	Adenosine	Diltiazem	Verapamil
<b>Dose</b>	<ul style="list-style-type: none"> <li>• Initial dose: 6 mg IV x1               <ul style="list-style-type: none"> <li>◦ Repeat 12 mg IV q1-2min x2 if not converted to NSR</li> </ul> </li> <li>• Can use an initial 12 mg dose if caffeine ingested within 4 hours</li> </ul>	<ul style="list-style-type: none"> <li>• Initial dose: 0.25mg/kg x1               <ul style="list-style-type: none"> <li>◦ Repeat 0.35 mg/kg IV in 15 minutes if not converted to NSR</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Initial dose: 2.5 to 5 mg x1               <ul style="list-style-type: none"> <li>◦ Repeat 5-10 mg IV every 15-30 minutes if not converted to NSR</li> </ul> </li> </ul>
<b>Admin</b>	IV bolus as proximal to heart as possible with stopcock, follow with saline flush	Slow IV push over 2-5 minutes	
<b>PK</b>	Onset: 20-30 seconds Duration: 10-20 seconds	Onset: ~3 minutes Duration: 3-4 hours	Onset: 2-7 minutes Duration: 2-5 hours
<b>Adverse Effects</b>	Dyspnea, chest tightness, dizziness, headache, facial flushing, nausea, "electric shock" sensation, transient AV block	Hypotension, worsening heart failure, bronchospasm, bradycardia, Caution in >1st degree AV block or SA node dysfunction	
<b>Mechanism of Action</b>	Slows conduction through the AV node through a different mechanism, binding to A1 receptors,	Inhibits calcium ion from entering slow channels or select voltage-sensitive areas of vascular smooth muscle and myocardium during depolarization	
<b>Conversion Rate</b>	87-92%	86~98%	
<b>Caution</b>	Contraindicated in preexcitation rhythms such as Wolff-Parkinson-White syndrome (WPW)		
<b>Pearls!</b>	Draw up adenosine in 20 mL syringe, then qs to 20 mL with normal saline Administer as a fast IV push <sup>5</sup>	Administering 1-2 grams of calcium gluconate prior to diltiazem administration may limit hypotension	

## Overview of Evidence

Author, year	Design & Sample Size	Intervention & Comparison	Outcomes
Sternbach et al., 1986	Observational (n=11)	Diltiazem IV: 0.25 mg/kg over 5 min	<ul style="list-style-type: none"> <li>• <b>Conversion to NSR in 64% of patients</b></li> <li>• Significant ↓ HR and ↓ SBP</li> </ul>
McCabe et al., 1991	Observational (n=37)	Adenosine IV: 6 mg x1 rapid push, then 12 mg q2 min x2 if not converted	<ul style="list-style-type: none"> <li>• <b>88% conversion in patients with SVT</b></li> </ul>
Hood et al., 1992	Prospective, crossover RCT (n=25)	Verapamil IV: 70 mcg/kg administered over 5 min and repeated q5 min up to 15 mg Adenosine IV: rapid 40 mcg/kg increments q2 min (max 20 mg)	<ul style="list-style-type: none"> <li>• <b>No significant difference in conversion</b></li> <li>• ↑ SBP after conversion with adenosine</li> <li>• No change in mean SBP after conversion with verapamil</li> </ul>
Madsen et al., 1995	Hybrid prospective/retrospective (n=191)	Verapamil IV: 2.5 mg x1, then 5 mg x1 if not converted Adenosine IV: 6 mg x1, then 12 mg x1 if not converted	<ul style="list-style-type: none"> <li>• <b>No significant difference in conversion (64% vs 78%)</b></li> <li>• Adenosine more often used first-line</li> </ul>
Brady Jr et al., 1996	Hybrid prospective/retrospective (n=211)	Adenosine vs verapamil IV at variable doses	<ul style="list-style-type: none"> <li>• <b>No significant difference in conversion, trend toward ↑ conversion with CCB (69% vs 88%; p=0.11)</b></li> <li>• No difference in recurrence of SVT (p=0.48 out-of-hospital; p=0.88 in-hospital)</li> </ul>
Lim et al., 2009	Prospective RCT (n=206)	Verapamil IV: 1 mg/min (max 20 mg) or Diltiazem IV 2.5 mg/min (max 50 mg) Adenosine IV: 6 mg x1, then 12 mg if not converted	<ul style="list-style-type: none"> <li>• <b>↑ conversion rate with CCB (98% vs. 86.5%)</b></li> <li>• 1 patient had hypotension with CCB</li> <li>• Mean SBP drop of 13 mmHg with verapamil and 7 mmHg with diltiazem</li> </ul>
Dogan et al., 2015	Retrospective (n=77)	Diltiazem IV: 0.25 mg/kg x1 over 2 min, then 0.35 mg/kg x1 if not converted Adenosine IV: 6 mg x1, then 12 mg IV x2 if not converted	<ul style="list-style-type: none"> <li>• <b>↑ conversion rate after first-dose with CCB (95% vs 59.6%; p=0.00)</b></li> <li>• CCB also more successful overall (96.9% vs 71.9%; p=0.00)</li> <li>• Total dose for conversion: diltiazem IV 32 mg vs adenosine IV 41 mg</li> </ul>
Alabed et al., 2017	Cochrane review (n=622)	Adenosine vs CCB IV at variable doses	<ul style="list-style-type: none"> <li>• <b>No significant difference in conversion rate (89.7% vs. 92.9%)</b></li> <li>• 1 reported case of hypotension CCB group not requiring treatment</li> </ul>

## Conclusions

- **CCBs may be as effective as adenosine in terminating SVT** and may be better tolerated by patients.
- Decrease in SBP with CCBs may be negligible if patients are normotensive.
- There is not enough evidence to recommend one agent over in the absence of contraindications.

## References

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