



Calcium Channel Blockers in SVT in Adults

Introduction

1. American Heart Association and American College of Cardiology guidelines both recommend non-pharmacologic in addition to pharmacologic therapies for acute management of SVT in adult patients
2. The typical first line medication for managing stable SVT is an adenosine push
3. Unpleasant side effects of adenosine are the sensation of “impending doom,” headache, dizziness, facial flushing, and dyspnea
4. Because propagation of the action potential through the atrioventricular node is calcium-channel dependent, the non-dihydropyridine calcium channel blockers are highly effective treatment option
5. It is important to note that non-dihydropyridine calcium channel blockers are **contraindicated** in infants. See the section below regarding recommendations in pediatrics

	Diltiazem	Verapamil
Mechanism of Action	Blocks calcium ion influx during depolarization of cardiac muscle	
Dose	0.25 mg/kg followed by 0.35 mg/kg if ineffective *some patients may respond to lower doses such as 0.15 mg/kg	5-10 mg followed by additional 10 mg after 30 minutes if ineffective
Administration	Slow IV push	Slow IV push
PK/PD	Onset: 3 minutes Duration: 1-3 hours Half-life elimination: ~3.4 hours	Onset: 1-5 minutes Duration: 0.5-6 hours Half-life elimination: 4-12 hours
Significant Adverse Effects	First-degree AV block, second-degree AV block, complete AV block, sinus bradycardia	
Contraindications/Precautions	Contraindications: Sick sinus syndrome, second- or third- degree AV block, severe hypotension, cardiogenic shock, Wolff-Parkinson-White Syndrome, VTach Precautions: Left ventricular dysfunction, hepatic impairment, renal impairment	

Overview of Evidence

Author, year	Design/ sample size	Intervention & Comparison	Outcome
Barre S, et al; 2023	Single center, retrospective cohort study N = 34	Adenosine 6 mg IV (n = 20) Vs Diltiazem 15 mg or less (average 13.5 mg; 0.16 mg/kg) (n = 14)	No significant difference in: -Rate of SVT attenuation (55% vs 71.4%; p=0.48) -SVT recurrence within 2 hours (9.1% vs 10%; p=1.0) -Admission rate (35% vs 42.9%; p=0.73) No major differences in incidence of bradycardia or hypotension between groups
Nithin P, et al; 2021	Prospective randomized controlled study N = 52	Adenosine 6 mg IV followed by 12 mg followed by diltiazem if not reverted (n = 26) Vs Diltiazem 0.25 mg/kg IV followed by 0.35 mg/kg if conversion not achieved followed by continuous infusion (n = 26)	-Conversion rates with the diltiazem group were significantly greater than with the adenosine group (100% vs 76.9%; p=0.023) -No significant difference in mean change in the blood pressure -No significant difference in adverse events
Alabed S, et al; 2017	Update to the Holdgate systematic review performed in 2006 (see below) to include N = 622 patients in 7 trials	Calcium Channel Blockers Vs Adenosine	-Reversion rates were not significantly different between the calcium channel blocker group and the adenosine group (92.9% vs 89.7%) -There were significantly shorter times to reversion in the adenosine group than there were in the calcium channel blocker group (44 seconds vs 394 seconds) -There were no significant differences in rate of relapse between the adenosine group and the calcium channel blocker group (3.3% vs 1.14%) -There was no significant difference in rates of hypotension between the calcium channel blocker group and the adenosine group
Dogan H, et al; 2015	Retrospective review N = 77	Adenosine 6 mg IV followed by 12 mg IV followed by 12 mg IV if not converted (n = 57) Vs Diltiazem 0.25 mg/kg IV followed by 0.35 mg/kg if not converted (n = 20)	-Conversion with the first dose of diltiazem was significantly greater than with the first dose of adenosine (95% vs 59.6%; p=0.00) -The total conversion rate with diltiazem was significantly greater than the total conversion rate with adenosine (96.9% vs 71.92%; p=0.00) -There was no significant difference in rates of hypotension between diltiazem and adenosine

<p>Delaney B, et al; 2011</p>	<p>Meta-Analysis N = 692 in 8 trials</p>	<p>Adenosine Vs Calcium Channel Blockers</p>	<p>Conversion rate -No significant difference between adenosine and calcium channel blockers (91% vs 90%)</p> <p>Minor Side Effects -Significantly greater in the adenosine group than in the calcium channel blockers group</p> <p>Hypotension -Hypotension rates were significantly higher in the calcium channel blocker group than in the adenosine group (3.7% vs 0.6%)</p>
<p>Holdgate A, et al; 2006</p>	<p>Systematic Review N = 577 patients in 8 trials</p>	<p>Calcium Channel Blockers Vs Adenosine</p>	<p>Reversion Rate -No significant difference between adenosine and verapamil (92.2% vs 89.0%; p=0.15)</p> <p>Time to Reversion -4 studies reported time to reversion: statistically significant shorter time to revision with adenosine compared to diltiazem</p> <p>Relapse Rate -3 studies reported rate of relapse: no significant difference in rate of relapse between verapamil and adenosine (1.9% vs 10.2%; p=0.09)</p> <p>Adverse Effects -Chest tightness, nausea rates, and shortness of breath rates were significantly greater in the adenosine group than in the verapamil group -Hypotension rates were not significantly different between the adenosine and verapamil groups</p>

Conclusions

Adenosine and non-dihydropyridine calcium channel blockers (diltiazem preferred) are both reasonable choices for termination of SVT in adult patients. Use of calcium channel blockers is associated with less negative side effects that are associated with adenosine use (impending doom feeling, chest tightness, flushing, etc), but may come with greater risk for hypotension (this is more common with verapamil than with diltiazem).

Recommendations for Pediatrics

Non-dihydropyridine Calcium Channel Blockers (verapamil and diltiazem) are considered **contraindicated** in infants less than 12 months of age and are generally not recommended in young children. Infants lack calcium stores within the sarcoplasmic reticulum in order to allow contraction when the calcium channel is blocked. This can result in severe apnea, bradycardia, hypotensive reactions, and **cardiac arrest** in infants. For older children verapamil and diltiazem are not included in the PALS tachyarrhythmia algorithm. SVT in infants is treated with adenosine and typically a beta blocker such as propranolol or other antiarrhythmics. It is highly recommended to discuss with pediatric cardiology if patients do not respond to adenosine.

Courtesy of Kelcee Widdess, PharmD, BCPPS

References

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