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Calcium Channel Blockers (CCB) vs Adenosine for Supraventricular Tachycardia (SVT)

1. SVT indicates tachycardia with atrial rates >100 beats per minute
    a. Traditionally excludes ventricular tachycardias and atrial fibrillation (AF)
    b. Includes: atrial tachycardias, atrioventricular (AV) junctional tachycardias, and AV reentrant tachycardias
2. Immediate direct-current (DC) cardioversion is indicated in hemodynamically unstable patients
3. More options available for management of hemodynamically stable patients in SVT of unknown etiology
    a. First-line: vagal maneuvers
        i. Valsalva maneuver or carotid sinus massage
    b. Second-line (strength of recommendation varies by ACC and ESC)
        i. Adenosine
        ii. IV non-dihydropyridine calcium channel blockers (i.e. diltiazem or verapamil)
        iii. IV beta-blockers (i.e. esmolol or metoprolol)

Pharmacology [1-4]

	Adenosine	Diltiazem	Verapamil

Dose	• 6 mg x 1
	  ○ Repeat 12mg q1-2min x2 if no effect
	• Can use an initial 12 mg dose of caffeine ingested within 4 hours
		• 0.25mg/kg
		  ○ Repeat with 0.35 mg/kg IV in 15 minutes if needed
			• 2.5 to 5 mg
			  ○ Repeat with 5-10 mg IV every 15-30 minutes

Administration	IV bolus as proximal to heart as possible with stopcock or diluted in 20-30 ml normal saline	Slow IV push over 2-5 mins	
PK	Onset: 20-30 sec Duration: 10-20 sec	Onset: ~3 min Duration: 3-4 hours	Onset: 2-7 min Duration: 2-5 hours
Adverse Effects	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	
Mechanism of Action	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	
Conversion Rate	87-92%	86~98%	
Caution	Contraindicated in preexcitation rhythms such as Wolff-Parkinson-White syndrome (WPW)		
Comments	PEARL: Draw up adenosine dose in 20 mL syringe then qs to 20 mL with normal saline and use to IV fast push5	PEARL: Administering 1-2 grams of calcium gluconate prior to diltiazem administration may limit hypotension	

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Overview of Evidence

Author, year	Design/ sample size	Intervention & Comparison	Outcome
Sternbach et al. 1986	Observational; n=11	IV diltiazem 0.25 mg/kg over 5 min	• **Conversion in 64% patients** • Significant ↓ in HR and ↓ SBP of 12.4 mmHg
McCabe et al. 1991	Observational; n=37	IV adenosine 6 mg rapid push then 12 mg q2 min x2 if no effect	• **88% conversion in patients with SVT**
Hood et al. 1992	Prospective, crossover, RCT; n=25	I1 = IV adenosine administered in rapid 40 mcg/kg increments q2 min up to 20 mg I2 = IV verapamil at 70 mcg/kg administered over 5 min and repeated q5 min up to 15 mg	• **No significant difference in conversion** • ↑ SBP after conversion with adenosine • No change in mean SBP after conversion with verapamil
Gauche et al. 1994	Observational; n=129	IV adenosine 12 mg rapid push, repeated x1 after 2 min if no effect	• **85% conversion with the first dose** • 31% conversion with the second dose • 24% of patients appeared in severe distress after administration
Lim et al. 2002	Prospective, RCT; n=184	IV verapamil 1 mg/min up to 20 mg Vs. IV diltiazem 2.5 mg/min up to 50 mg	• 98.8% conversion rate for verapamil • 96.3% conversion rate for diltiazem • **No significant differences in success rate**
Lim et al. 2009	Prospective, RCT; n=206	I = either IV verapamil 1 mg/min up to 20 mg or IV diltiazem 2.5 mg/min up to 50 mg toal C = IV adenosine 6 mg followed by 12 mg if needed	• **↑ conversion rate with CCBs (98% vs. 86.5%)** • 1 patient developed hypotension with CCBs, • Mean SBP drop of 13 mmHg with verapamil and 7 mmHg with diltiazem
Alabed et al. 2017	Cochrane review; n=622	Adenosine vs CCBs at variable doses	• **No significant difference in conversion rate (89.7% vs. 92.9%)** • 1 reported case of hypotension CCB group not requiring treatment

Conclusions: **Diltiazem may be as effective as adenosine in terminating SVT** and may be better tolerated by patients. The decrease in systolic blood pressure may not be much of a concern if patients are normotensive. There is not enough evidence to recommend one agent over in the absence of contraindications to either age

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