Adenosine

Brand names	Adenocard IV, Adenoscan, generic
Medication error potential	High-alert medication (anti-arrhythmic) that has an increased risk of causing significant patient harm if it is used in error.[1]
Contraindications and warnings	**Contraindications:** Known hypersensitivity to adenosine or any components of the formulation.[2] Adenosine should not be given in second- or third-degree atrioventricular (AV) block or sinus node disease (e.g., sick sinus syndrome, symptomatic bradycardia), unless a functioning artificial pacemaker is placed.[2] Adenosine should also not be used in patients with Wolff-Parkinson-White syndrome or wide complex tachycardia.[3] Although not listed in the prescribing information, some suggest that adenosine should be contraindicated in heart transplant recipients as it may cause prolonged asystole.[4] **Warnings** **Arrhythmias, postconversion:** A variety of new rhythms (e.g., premature ventricular contractions, atrial premature contractions, sinus bradycardia, sinus tachycardia, skipped beats, and varying degrees of AV nodal block) may appear on the ECG at the time of conversion to normal sinus rhythm; however, these generally last only a few seconds and resolve without intervention.[2] **Bronchoconstriction:** Patients with a history of reactive airway disease may experience bronchospasm and respiratory failure.[2,5-7] Aminophylline has been used to relieve bronchospasm associated with adenosine.[7] **Heart block:** Adenosine decreases conduction through the AV node and may produce first-, second-, or third-degree heart block, which is generally self-limiting due to adenosine's short half-life. Additional doses should not be given if high-level block develops after one dose.[2] Transient or prolonged episodes of asystole have been fatal. Rarely, ventricular fibrillation has been reported following adenosine administration, including both resuscitated and fatal events.[2]
Infusion-related cautions	Although adenosine can be administered via peripheral, it may be more effective if given close to the heart via central line administration.[3] Normal saline flushes should be 5–10 mL for infants and children and 20 mL for *adults*.[28]
Dosage	**Paroxysmal supraventricular tachycardia** **Initial dosing:** 0.05–0.1 mg/kg[2-4,12-17,28] up to a maximum 6 mg for the *first* dose.[3,28] Infuse over 1–2 seconds, then immediately and rapidly flush the catheter with normal saline. (See the Infusion-Related Cautions section.)[2,3] One report noted that only 9% of infants responded to a dose of 0.05 mg/kg and that the median effective dose was 0.15 mg/kg.[12] The maximum single initial dose is 0.3 mg/kg in neonates, 0.5 mg/kg in children,[18] and 6 mg in *adults*.[3] One report suggests that a larger initial dose of 0.2–0.25 mg/kg in both infants and children may reduce the risk of unsuccessful cardioversion by 35%.[19] **Subsequent dosing:** Supraventricular tachycardia is terminated in 60% to 80% of patients treated with 6 mg of adenosine and in 90–95% of those treated with 12 mg.[4] If conversion does not occur in 30 seconds, double the dose and immediately and rapidly flush the catheter with normal saline.[28] This process should continue until sinus rhythm is established or a maximum *single (NOT cumulative)* dose of 0.3 mg/kg (maximum of 12 mg) has been given.[2,3,29] One study reported a single dose as large as 0.4–0.6 mg/kg for successful conversion of a 7-week-old with refractory SVT.[30] **Pretreatment in children undergoing cardiac surgery (prevention of ischemia and reperfusion injury):** Adenosine was infused through a central venous catheter at 0.05 mg/kg/min for the first minute, then increased by 0.05 mg/kg/min each minute up to 0.35 mg/kg/min (maximum dose maintained for 4 additional minutes). The total dose of adenosine was 2.45 mg/kg over 10 minutes. There was a 5-minute interval between the completion of adenosine and initiation of cardiac bypass surgery.[20]

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Dosage *(cont.)*	**Pulmonary hypertension:** 25–50 mcg/kg/min has been associated with improved PaO_2,[8-10] decreased pulmonary arterial pressure,[9] and rapid weaning of oxygen, ventilator support, and nitric oxide[10] in some neonates and infants with persistent pulmonary hypertension. One patient experienced hypotension when the dose was increased to 80 mcg/kg/min, but blood pressure corrected after the dose was decreased to 50 mcg/kg/min.[9] No other reports of tachycardia or hypotension were noted.[8-10] Neonates with irreversible lung disease may not respond. **Pharmacological stress test:** 0.14 mg/kg/min for 6 minutes in children with aortic valve disease or Kawasaki disease.[11]
Dosage adjustment in organ dysfunction	No dosage adjustment is necessary in renal dysfunction.[21]
Maximum dosage	The maximum single dose is 0.3 mg/kg in neonates, 0.5 mg/kg in children,[18] and up to 12 mg in *adults*.[2,3] A preterm neonate receiving theophylline required doses of 0.4–0.8 mg/kg to convert to normal sinus rhythm.[22] Over a 14.5-hour period, a 3-week-old was given 119 doses of 0.1–0.2 mg/kg.[23] A 14-year-old adolescent who failed to respond to an 18-mg dose was believed to have ventricular tachycardia.[17] (See the Comments section.)
Additives	9 mg/mL of sodium[24]
Suitable diluents	D5W, NS, LR, and D5LR[24]
Maximum concentration	3 mg/mL (available commercially).[2] Futher dilution may be required to ensure accurate delivery.
Preparation and delivery	*Parenteral products should be visually inspected for particulate matter and discoloration before use. Refer to appropriate references for more information on compatibility with other drugs and solutions; compatibility following Y-site delivery, and suggested storage and extended stability.*[24] **Stability:** Store at room temperature. Do not refrigerate as crystallization may occur. Crystals may be dissolved by warming to room temperature. The solution must be clear at the time of use.[24]
IV push	Should be given over 1–2 seconds either directly into a vein or, if given into an IV line, it should be given as close to the patient as possible and followed by a rapid saline flush. Adenocard IV[2,3,24] or by continuous infusion (Adenoscan).[24]
Intermittent infusion	Not given via this method
Continuous infusion	Nine infants received a continuous infusion of adenosine (3 mg/mL in NS) for a 24-hour period.[8] Another child received a continuous infusion, but the concentration and solution type were not provided.[25]
Other routes of administration	IO in emergencies,[3,26,28,29] but one case series reported inability to successfully convert the arrhythmia following administration by this method.[26]