

**Drugs**

When mechanical means fail to re-establish adequate circulation, pharmacologic intervention is essential (Table 38-4). If intravascular access is not present or rapidly established, administration through an intraosseous route is recommended. Some drugs can also be administered effectively through the endotracheal tube.

**Epinephrine**, a catecholamine with mixed  $\alpha$ -agonist and  $\beta$ -agonist properties, constitutes the mainstay of drug therapy for CPR. The  $\alpha$ -adrenergic effects are most important during acute phases of resuscitation, causing an increase in systemic vascular resistance that improves coronary blood flow. Standard dose therapy is recommended for the first and subsequent boluses. There is no benefit offered by high-dose epinephrine. Vasopressin, an endogenous hormone, causes constriction of capillaries and small arterioles and may be useful. Insufficient data support its routine use, but vasopressin may be considered in children failing standard medication administration.

The routine use of **sodium bicarbonate** is currently not recommended. Sodium bicarbonate may be judiciously used to treat toxidromes or hyperkalemic arrest; however, oxygen delivery and elimination of CO<sub>2</sub> must be established first. Side effects include hypernatremia, hyperosmolality, hypokalemia, metabolic alkalosis (shifting the oxyhemoglobin curve to the left and impairing tissue oxygen delivery), reduced ionized calcium level, and impaired cardiac function.

Routine administration of **calcium** is not recommended. It may be useful in cases of documented hypocalcemia, calcium channel blocker overdose, hypermagnesemia, or hypokalemia, but is otherwise not beneficial and potentially harmful.

Hypoglycemia is not uncommon in infants and children who sustain cardiac arrest. Blood glucose should be checked and hypoglycemia should be promptly treated with **glucose**.

Prompt electrical **defibrillation** is indicated when ventricular fibrillation or pulseless ventricular tachycardia is noted (Table 38-5). CPR should continue until immediately before

defibrillation and resume immediately afterward, minimizing interruptions in compressions. If a second attempt at defibrillation is necessary, it should be followed by a dose of epinephrine. Children failing two episodes of defibrillation may benefit from administration of amiodarone. Defibrillation should be distinguished from **cardioversion** of supraventricular tachycardias, which also may compromise cardiac output. Cardioversion requires a lower starting dose and synchronization of the discharge to the electrocardiogram to prevent discharging during a susceptible period, which may convert supraventricular tachycardia to ventricular tachycardia or fibrillation.

Table 38-5 Recommendations for Defibrillation and Cardioversion in Children	
<b>DEFIBRILLATION</b>	
Place self-adhesive defibrillation pads or paddles with electrode gel at the apex of the heart and the upper right side of the chest	
<ul style="list-style-type: none"> <li>• Use infant paddles or self-adhesive pads for children &lt;10 kg; adult size for children &gt;10 kg</li> </ul>	
Notify all participating personnel before discharging paddles so that no one is in contact with patient or bed	
Begin with 2 J/kg; resume chest compressions immediately	
If unsuccessful, increase to 4 J/kg and repeat	
Higher energy levels may be considered, not to exceed 10 J/kg or the adult maximum dose	
<b>CARDIOVERSION</b>	
Consider sedation if possible	
For symptomatic supraventricular tachycardia* or ventricular tachycardia with a pulse, synchronize signal with ECG	
Choose paddles, position pads, and notify personnel as above	
Begin with 0.5–1 J/kg	
If unsuccessful, use 2 J/kg	

ECG, Electrocardiogram.

\*Consider adenosine first (see Table 38-4)

Table 38-4 Drug Doses for Cardiopulmonary Resuscitation		
DRUG	INDICATION	DOSE
Adenosine	Supraventricular tachycardia	0.1 mg/kg (maximum 6 mg); second dose: 0.2 mg/kg (maximum 12 mg)
Amiodarone	Pulseless VF/VT Perfusing tachyarrhythmias	5 mg/kg; may repeat twice up to 15 mg/kg; maximum single dose 300 mg Dose as above but administer slowly over 20 to 60 minutes. Expert consultation strongly recommended.
Atropine	Supraventricular or junctional bradycardia	0.02 mg/kg (minimum dose 0.1 mg); up to 0.5 mg; higher doses needed in organophosphate poisoning
Bicarbonate	Hyperkalemia, some toxidromes	1 mEq/kg bolus; ensure adequate ventilation; monitor ABGs; can repeat every 10 min
Calcium chloride	Hypocalcemia, calcium channel blocker overdose, hypermagnesemia, hyperkalemia	20 mg/kg; maximum single dose 2 g; administer slowly
Epinephrine	Hypotension, chronotropy, inotropy	0.01 mg/kg IV/IO; 0.1 mg/kg ET; may repeat every 3–5 minutes; may promote arrhythmias
Fluid	Hypovolemia, sepsis	Administer crystalloid in 20 mL/kg boluses titrated to patient's physiologic needs
Glucose	Hypoglycemia	Newborns: 5–10 mL/kg 10% dextrose; infants and children: 2–4 mL/kg 25% dextrose; adolescents: 1–2 mL/kg 50% dextrose
Lidocaine	VT	1 mg/kg/bolus followed by 20–50 mcg/kg/min continuous infusion

Data from 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 14: Pediatric Advanced Life Support, Circulation 122 [suppl 3]:S876-S908, 2010.

ABG, Arterial blood gas; ET, endotracheal; IO, intraosseous; IV, intravenous; VF, ventricular fibrillation; VT, ventricular tachycardia.