Emergency Drug Index

DRUG IDENTIFICATION GUIDE

The *Emergency Drug Index* is a list of commonly prescribed medications that are used in prehospital care; it is not intended to be a complete guide to all emergency medications. For additional drug information, consult other standard references. Drugs included in this index are listed alphabetically by generic name. Common trade names are shown in parentheses following the generic listing.

NOTE

The way in which drugs are packaged and supplied varies by manufacturer. It is important that paramedics verify how a particular drug is supplied by their EMS service. In addition, paramedics should verify the recommended dose or formula, know the indications and contraindications of any drug they administer, and take all safety precautions. Any concerns regarding the dose or administration of any drug should be guided by medical direction.

PREGNANCY CATEGORY RATINGS FOR DRUGS

Drugs have been categorized by the Food and Drug Administration according to the level of risk to the fetus. These categories are listed for each drug herein under "Pregnancy safety" and are interpreted as follows:

Category A: Controlled studies in women fail to demonstrate a risk to the fetus in the first trimester, and there is no evidence of risk in later trimesters; the possibility of fetal harm appears to be remote.

Category B: Either (1) animal reproductive studies have not demonstrated a fetal risk but there are no controlled studies in pregnant women or (2) animal reproductive studies have shown an adverse effect (other than decreased fertility) that was not confirmed in controlled studies on women in the first trimester and there is no evidence of risk in later trimesters.

Category C: Either (1) studies in animals have revealed adverse effects on the fetus and there are no controlled studies in women or (2) studies in women and animals are not available. Drugs in this category should be given only if the potential benefit justifies the risk to the fetus.

Category D: Positive evidence of human fetal risk exists, but the benefits for pregnant women may be acceptable despite the risk, as in life-threatening diseases for which safer drugs cannot be used or are ineffective. An appropriate statement must appear in the "Warnings" section of the labeling of drugs in this category.

Category X: Studies in animals or human beings have demonstrated fetal abnormalities, there is evidence of fetal risk based on human experience, or both; the risk of using the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant. An appropriate statement must appear in the "Contraindications" section of the labeling of drugs in this category.

ABCIXIMAB (REOPRO)

CLASS

Glycoprotein IIb/IIIa inhibitor

DESCRIPTION

Glycoprotein IIb/IIIa inhibitors inhibit the integrin GP IIb/IIIa receptor in the membrane of the platelets. As a result, they inhibit the common final pathway activation of platelet aggregation. Abciximab (in combination with aspirin and heparin) is indicated for use in patients undergoing PCI as well as for the treatment of unstable angina or NSTEMI infarction when PCI is planned within 24 hr.

ONSET AND DURATION

Onset: 2 hr

Duration: Platelet aggregation restored within 24-48 hr after infusion is stopped

INDICATIONS

Patients with NSTEMI, unstable angina, or PCI within 24 hr

CONTRAINDICATIONS

Active internal bleeding
Bleeding disorder
History of intracranial hemorrhage, neoplasm, AV malformation, aneurysm, or stroke within 2 years
Major surgical procedure or trauma within 6 weeks
Aortic dissection, pericarditis, and severe hypertension
Hypersensitivity to any GP IIb/IIIa inhibitor
Low platelet count (<100,000/mm^3)

ADVERSE REACTIONS

Anaphylactoid reaction/anaphylactic shock may occur
Bleeding (secondary to drug-induced platelet dysfunction)
GI bleeding
Hematemesis
Hematuria
Hypotension
Intracranial bleeding
Platelet dysfunction
Retroperitoneal bleeding
Stroke
Thrombocytopenia

DRUG INTERACTIONS

Concomitant use of other agents that may affect hemostasis, such as anticoagulants, other platelet inhibitors, NSAIDs, and thrombolytic agents, may be associated with an increased risk of bleeding.

HOW SUPPLIED

2 mg/mL (must be given with heparin)

DOSAGE AND ADMINISTRATION (ADULT)

PCI only: 0.25 mg/kg IV bolus (10-60 min before procedure); then 0.125 mcg/kg/min (max 10 mcg/min) IV infusion for 12 hr

ACS with planned PCI within 24 hr: 0.25 mg/kg IV bolus; then 10 mcg/min IV infusion for 18-24 hr, concluding 1 hr after PCI

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Readministration may cause hypersensitivity reaction.

ACTIVATED CHARCOAL (ACTIDOSE-AQUA, ACTIDOSE, LIQUI-CHAR)

CLASS

Adsorbent, antidote

DESCRIPTION

Activated charcoal is a fine black powder that binds and adsorbs ingested toxins. Once the drug binds to the

activated charcoal, the combined complex is excreted in the feces.

ONSET AND DURATION

Onset: Immediate
Duration: Continual while in gastrointestinal tract; reaches equilibrium once saturated

INDICATIONS

Many oral poisonings and medication overdoses

CONTRAINDICATIONS

Corrosives, caustics, petroleum distillates (relatively ineffective and may induce vomiting)

ADVERSE REACTIONS

May indirectly induce nausea and vomiting.
May cause constipation or mild, transient diarrhea.

DRUG INTERACTIONS

Syrup of ipecac (adsorbed by activated charcoal and will result in vomiting of the charcoal)

HOW SUPPLIED

25 g (black powder)/25g/125mL bottle (200 mg/mL)
50 g (black powder)/50g/240ml bottle (200 mg/mL)
Other sizes include 15 g and 30 g, bottles and squeeze tubes. Most products come premixed (not powder) with water (aqueous preparations) or with sorbitol, a cathartic.

DOSAGE AND ADMINISTRATION

From 1 to 2 g/kg body mass (larger amounts if food is also present), prepared in a slurry and administered PO or slowly via nasogastric or orogastric tube
Adult: 30-100 g
Pediatric (1-12 yr): 15-30 g or 1-2 g/kg
Infant (less than 1 yr): 1 g/kg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Charcoal frequently is administered to pregnant patients, and the potential benefit versus risk is very high. Because charcoal remains within the gastrointestinal tract, its risk to the fetus virtually is eliminated, unless the charcoal and other stomach contents are aspirated.
Activated charcoal also may be known as "AC."
Activated charcoal is relatively insoluble in water.
Activated charcoal may blacken feces.
Activated charcoal must be stored in a closed container.
Different charcoal preparations may have varying adsorptive capacity.
Activated charcoal does not adsorb all drugs and toxic substances (e.g., phenobarbital, aspirin, cyanide, lithium, iron, lead, and arsenic).

ADENOSINE (ADENOCARD)

CLASS

Endogenous nucleoside, miscellaneous antidysrhythmic

DESCRIPTION

Adenosine primarily is formed from the breakdown of adenosine triphosphate. Adenosine triphosphate and adenosine are found in every cell of the human body and have a wide range of metabolic roles. Adenosine slows supraventricular tachycardias by decreasing electrical conduction through the atrioventricular node without causing negative inotropic effects. It also acts directly on sinus pacemaker cells and vagal nerve terminals to decrease chronotropic (heart rate) activity. First drug of choice for most forms of stable, narrow-complex SVT. May be considered for unstable narrow-complex reentry tachycardia while preparing for cardioversion. Adenosine does not convert atrial fibrillation, atrial flutter, or VT.

ONSET AND DURATION

Onset: Immediate
Duration: 10 sec

INDICATIONS

First drug for most forms of narrow-complex paroxysmal supraventricular tachycardia and dysrhythmias associated with bypass tracts such as Wolff-Parkinson-White (WPW) syndrome in adults and pediatric patients.
In undifferentiated regular stable wide-complex tachycardia, IV adenosine may be considered relatively safe. It may convert the rhythm to sinus, and may help diagnose the underlying rhythm.

CONTRAINDICATIONS

Drug-induced tachycardia
Second- or third-degree atrioventricular block
Hypersensitivity to adenosine
Atrial flutter, atrial fibrillation, ventricular tachycardia, WPW with atrial fibrillation/flutter. (Adenosine is not effective in converting these rhythms to sinus rhythm.)

ADVERSE REACTIONS

Facial flushing
Light-headedness
Paresthesias
Headache
Diaphoresis
Palpitations
Chest pain
Flushing
Hypotension

Shortness of breath
Transient periods of sinus bradycardia, sinus pause, or bradyasystole
Ventricular ectopy (fibrillation, flutter, tachycardia, torsades de pointes)
Nausea
Metallic taste

DRUG INTERACTIONS

Methylxanthines (e.g., caffeine and theophylline) antagonize the action of adenosine.
Dipyridamole potentiates the effect of adenosine; reduction of adenosine dose may be required.
Carbamazepine may potentiate the atrioventricular-nodal blocking effect of adenosine.

HOW SUPPLIED

Parenteral for IV injection
3 mg/mL in 2-mL and 5-mL flip-top vials

DOSAGE AND ADMINISTRATION

Adult: Initial dose: 6-mg rapid IV bolus over 1-3 sec, followed by a 20-mL saline bolus; then elevate extremity. A second dose (12 mg) may be given in 1-2 min if needed.
Injection technique: Place patient in mild reverse Trendelenburg position before drug administration. Record ECG during drug administration. Draw up adenosine and flush in 2 separate syringes. Attach both syringes to the IV injection port closest to the patient. Clamp IV tubing above injection port. Push adenosine as quickly as possible (1-3 sec). Maintain pressure on adenosine plunger while pushing saline flush as rapidly as possible after adenosine. Unclamp IV tubing.
Pediatric: Initial dose 0.1 mg/kg IV/IO (max single dose: 6 mg); second dose 0.2 mg/kg IV/IO rapid push; followed with 5-10 mL NS flush[1]

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
A brief period of asystole (up to 15 sec) following conversion, followed by resumption of normal sinus rhythm, is common after rapid administration.
Reduce initial dose to 3 mg in patients receiving dipyridamole or carbamazepine, in heart transplant patients, or if given by central venous access.
Patients taking theophylline or caffeine may require larger doses of adenosine.
Deterioration (including hypotension) may result if given for irregular, polymorphic wide-complex tachycardia/VT.
Adenosine may produce bronchoconstriction in patients with asthma and in patients with bronchopulmonary disease.

ALBUTEROL (PROVENTIL AND OTHERS)

CLASS

Sympathomimetic, bronchodilator, beta$_2$ agonist

DESCRIPTION

Albuterol is a sympathomimetic that is selective for beta$_2$-adrenergic receptors. It relaxes smooth muscles of the bronchial tree and peripheral vasculature by stimulating adrenergic receptors of the sympathetic nervous system.

ONSET AND DURATION

Onset: 5-8 min after inhalation
Duration: 2-6 hr after inhalation

INDICATIONS

Relief of bronchospasm in patients with reversible obstructive airway disease
Prevention of exercise-induced bronchospasm
Anaphylaxis
Hyperkalemia

CONTRAINDICATIONS

Prior hypersensitivity reaction to albuterol or levalbuterol
Cardiac dysrhythmias associated with tachycardia (precaution)

ADVERSE REACTIONS

Usually dose-related
Restlessness, apprehension
Dizziness
Palpitations, tachycardia
Dysrhythmias
Tremors

DRUG INTERACTIONS

Other sympathomimetics may exacerbate adverse cardiovascular effects.
MAO inhibitors and tricyclic antidepressants may potentiate effects on the vasculature (vasodilation).
Beta blockers may antagonize albuterol.
Albuterol may potentiate diuretic-induced hypokalemia.

HOW SUPPLIED

Metered-dose inhaler: 90 mcg/metered spray (17-g canister with 200 inhalations)
Solution for aerosolization: 0.5% (5 mg/mL); 0.083% (2.5 mg) in 3-mL unit dose/nebulizer

DOSAGE AND ADMINISTRATION

Bronchial Asthma/Anaphylaxis/Hyperkalemia
Adult:
Metered-dose inhaler: 1-2 inhalations (90-180 mcg) q 4-6 hr (wait 5 min between inhalations); max 12 inhalations/day

Solution: 2.5 mg (0.5 mL of 0.5% solution) diluted to 3 mL with 0.9% NS (0.083% solution); administer over 5-15 min; 3-4 times/day by nebulizer

NOTE: In settings of severe asthma exacerbation, 4 inhalations or 5 mg in 2.5-3 mL is indicated.

Pediatric:

Metered-dose inhaler: 4-8 puffs (inhalation) as needed, with spacer if not intubated

Solution: 0.01-0.03 mL (0.05-0.15 mg)/kg/dose to max of 0.50 mL/dose diluted in 2 mL of 0.9% NS; may be repeated q 20 min

Nebulized albuterol: <20 kg: 2.5 mg/dose (inhalation); >20 kg: 5 mg/dose (inhalation)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

Albuterol may precipitate angina pectoris and dysrhythmias.

Albuterol should be used with caution in patients with diabetes mellitus, hyperthyroidism, prostatic hypertrophy, seizure disorder, or cardiovascular disorder.

In prehospital emergency care, albuterol should be administered only via inhalation.

ALTEPLASE (t-PA)

CLASS

Fibrinolytic

DESCRIPTION

Tissue plasminogen activator is a naturally occurring enzyme that has been mass-produced using recombinant DNA technology. The enzyme binds to fibrin-bound plasminogen at the site of an arterial clot, thus converting plasminogen to plasmin. Plasmin digests the fibrin strands of the clot, causing clot lysis and restoration of perfusion to the occluded artery. In prehospital care, fibrinolytic agents are used in treating selected patients with acute evolving myocardial infarction. (Other indications include ischemic stroke, deep vein thrombosis, peripheral artery embolism, IV catheter occlusion.)

ONSET AND DURATION

Onset: Clot lysis often occurs within 30 min.

Duration: 30-45 min (80% cleared in 10 min)

INDICATIONS

Acute evolving myocardial infarction

Massive pulmonary emboli

Deep venous thrombosis

Arterial thrombosis and embolism

To clear arteriovenous cannulae

Acute stroke

CONTRAINDICATIONS

Active bleeding or known bleeding disorder

Recent surgery (within 2-3 weeks)

Recent cerebrovascular accident

History of intracranial hemorrhage

Prolonged cardiopulmonary resuscitation

Recent intracranial or intraspinal surgery

Recent significant trauma (particularly head trauma)

Seizure at onset of stroke symptoms

Uncontrolled hypertension

Recent gastrointestinal bleeding

ADVERSE REACTIONS

Bleeding (gastrointestinal, genitourinary, intracranial, other sites)

Allergic reactions

Hypotension

Chest pain

Reperfusion dysrhythmias

Abdominal pain

DRUG INTERACTIONS

Acetylsalicylic acid may increase risk of bleeding (and may be beneficial in improving overall effectiveness).

Heparin and other anticoagulants also may increase risk of bleeding and improve overall effectiveness.

HOW SUPPLIED

50, 100 mg/vial with 50, 100 mL, and 2 mg (Cathflo) of diluent, respectively. May dilute further with equal amounts of 0.9% sodium chloride or D_5W.

DOSAGE AND ADMINISTRATION (BASED ON PATIENT'S WEIGHT)

Adult STEMI: Give 15 mg IV bolus, then 0.75 mg/kg over next 30 min (not to exceed 50 mg), and then 0.5 mg/kg over 60 min (not to exceed 35 mg); maximum total dose 100 mg. (Other doses may be prescribed by medical direction; different dosing is indicated for stroke.)

Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

Obtain blood sample for coagulation studies before administration.

Gently roll—do not shake—the vial to mix powder with liquid.

Closely monitor vital signs.

Observe for bleeding.

Do not administer IM injections to patients receiving fibrinolytic drugs.

No arterial blood gas specimens should be drawn on potential fibrinolytic therapy candidates due to bleeding tendency.

Use caution when moving patient to avoid bleeding or bruising.

Use one IV line exclusively for fibrinolytic administration.

AMIODARONE (CORDARONE)

CLASS

Class III antidysrhythmic

DESCRIPTION

Amiodarone is a unique antidysrhythmic agent with multiple mechanisms of action. The drug prolongs the duration of the action potential and the effective refractory period, and when given short-term IV, probably includes noncompetitive beta-adrenergic receptor and calcium channel blocker activity.

ONSET AND DURATION

Onset: Within minutes
Duration: Variable

INDICATIONS (IV USE)

Initial treatment and prophylaxis of frequently recurring ventricular fibrillation and hemodynamically unstable ventricular tachycardia in patients unresponsive to shock delivery, CPR, and vasopressors
Recurrent hemodynamically unstable VT
Treatment of some stable atrial and ventricular dysrhythmias

CONTRAINDICATIONS

Pulmonary congestion
Cardiogenic shock
Second- or third-degree AV block if no pacemaker present
Bradycardia
Sensitivity to amiodarone or iodine

ADVERSE REACTIONS

Hypotension
Headache
Dizziness
Bradycardia
Atrioventricular conduction abnormalities
Flushing
Abnormal salivation
Pain at IV site
Liver function abnormalities
Congestive heart failure
Abnormal thyroid function

DRUG INTERACTIONS

May potentiate bradycardia and hypotension with beta blockers and calcium channel blockers.
May increase risk of atrioventricular block and hypotension with calcium channel blockers.
May increase anticoagulant effects of warfarin.
May decrease metabolism and increase serum levels of phenytoin, procainamide, quinidine, and theophyllines.
Routine use in combination with drugs that prolong the Q-T interval is not recommended.
Y-site incompatibilities with furosemide, heparin, and sodium bicarbonate

HOW SUPPLIED

50 mg/mL vials

DOSAGE AND ADMINISTRATION

Adult:
- Pulseless arrest unresponsive to CPR, shock, and vasopressors: 300 mg IV/IO push. If needed, second dose of 150 mg IV/IO push
- Life-threatening dysrhythmias: Max cumulative dose: 2.2 g IV/24 hr. May be given as rapid infusion 150 mg IV over first 10 min (15 mg/min) repeated every 10 min as needed. Slow infusion: 360 mg IV over 6 hr (1 mg/min). Maintenance infusion: 540 mg IV over 18 hr (0.5 mg/min)

Pediatric:
- Refractory VF, pulseless VT: 5 mg/kg rapid IV/IO bolus; can be repeated to total dose of 15 mg/kg (2.2 g in adolescents) IV per 24 hr; max single dose: 300 mg
- Perfusing supraventricular and ventricular dysrhythmias: Loading dose 5 mg/kg IV/IO over 20-60 min (max single dose: 300 mg); can repeat to a max of 15 mg/kg (2.2 g in adolescents) per day IV

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D
Rapid infusion may cause hypotension.
Continuous electrocardiogram monitoring is required.
Slow infusion or discontinue if bradycardia or atrioventricular block occurs.
Do not give with other drugs that prolong Q-T interval (e.g., procainamide).
Maintain at room temperature and protect from excessive heat.

ASPIRIN (ASA, BAYER, ECOTRIN, ST. JOSEPH, OTHERS)

CLASS

Analgesic, antiinflammatory, antipyretic, antiplatelet

DESCRIPTION

Aspirin decreases inflammation (analgesic effect not limited to effects in CNS), dilates peripheral vessels, and decreases platelet aggregation. The use of aspirin is strongly recommended for all patients with acute coronary syndrome.

ONSET AND DURATION

Onset: 15-30 min
Duration: 4-6 hr

INDICATIONS

Mild to moderate pain or fever
Prevention of platelet aggregation in ischemia and thromboembolism
All patients with ACS
Any patient with symptoms of ischemic chest pain

Unstable angina
Prevention of myocardial infarction or reinfarction

CONTRAINDICATIONS

Hypersensitivity to salicylates
Gastrointestinal bleeding
Active ulcer disease or acute asthma (relative contraindication)
Hemorrhagic stroke
Bleeding disorders
Children with flulike symptoms

ADVERSE REACTIONS

Stomach irritation
Heartburn or indigestion
Nausea or vomiting
Allergic reaction

DRUG INTERACTIONS

Decreased effects with antacids and steroids
Increased effects with anticoagulants, insulin, oral hypoglycemics, fibrinolytic agents

HOW SUPPLIED

Tablets (65, 81, 325, 500, 650, 975 mg)
Capsules (325, 500 mg)
Controlled-release tablets (800 mg)
Suppositories (varies from 60 mg to 1.2 g)

DOSAGE AND ADMINISTRATION

Adult: Mild pain and fever: 325-650 mg PO q 4 hr
ACS: 160-325 mg PO non–enteric-coated tablet (chewing is preferable to swallowing); may use rectal suppository for patients who cannot take orally
Pediatric: Not indicated in prehospital setting

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D in third trimester, Category C in first and second trimesters
Should be given as soon as possible to the patient with ACS.

ATENOLOL (TENORMIN)

CLASS

Beta-blocking agent

DESCRIPTION

Atenolol competes with beta-adrenergic agonists for available beta-receptor sites on the membranes of cardiac muscle, bronchial smooth muscle, and the smooth muscle of blood vessels. The $beta_1$-blocking action on the heart decreases heart rate, conduction velocity, myocardial contractility, and cardiac output. Atenolol is used to control ventricular response in supraventricular tachydysrhythmias (paroxysmal supraventricular tachycardia, atrial fibrillation, atrial flutter). Atenolol is considered a second-line agent after adenosine, diltiazem, or digitalis derivative.

ONSET AND DURATION

Onset: Within 10 min (IV)
Duration: 2-4 hr

INDICATIONS

All patients with suspected MI and unstable angina in the absence of contraindications (can reduce the incidence of VF)
Useful as an adjunctive agent with fibrinolytic therapy (may reduce nonfatal reinfarction and recurrent ischemia)
To convert to normal sinus rhythm or to slow ventricular response (or both) in supraventricular tachydysrhythmias (reentry SVT, atrial fibrillation, or atrial flutter)
To reduce myocardial ischemia in AMI patients with elevated heart rate, blood pressure, or both

CONTRAINDICATIONS

Hemodynamically unstable patients
STEMI if signs of heart failure, low cardiac output, or increased risk for cardiogenic shock are present
Relative contraindications include P-R interval >0.24 sec, second- or third-degree heart block, active asthma, reactive airway disease, severe bradycardia, SBP <100 mm Hg.
Not available intravenously in the United States

ADVERSE REACTIONS

Bradycardia
Atrioventricular conduction delays
Hypotension
Bronchospasm

DRUG INTERACTIONS

Atenolol may potentiate antihypertensive effects when given to patients taking calcium channel blockers or MAO inhibitors; catecholamine-depleting drugs may potentiate hypotension; sympathomimetic effects may be antagonized; signs of hypoglycemia may be masked.

HOW SUPPLIED

5 mg in 10-mL ampules (injectable form is not available in the United States)

DOSAGE AND ADMINISTRATION

Adult: 5 mg slow IV (over 5 min); wait 10 min and then give second dose of 5 mg over 5 min
Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Atenolol must be given slowly IV over 5 min.
Concurrent IV administration with IV calcium channel blockers such as verapamil or diltiazem can cause severe hypotension.
Atenolol should be used with caution in persons with liver or renal dysfunction.

ATROPINE SULFATE (ATROPINE AND OTHERS)

CLASS

Anticholinergic agent

DESCRIPTION

Atropine sulfate (a potent parasympatholytic) inhibits actions of acetylcholine at postganglionic parasympathetic (primarily muscarinic) receptor sites. Small doses inhibit salivary and bronchial secretions; moderate doses dilate pupils and increase heart rate. Large doses decrease gastrointestinal motility, inhibit gastric acid secretion, and may block nicotinic receptor sites at the autonomic ganglia and at the neuromuscular junction. Blocked vagal effects result in increased heart rate and enhanced atrioventricular conduction with limited or no inotropic effect. In emergency care, atropine primarily is used to increase the heart rate in life-threatening or symptomatic bradycardia and to antagonize excess muscarinic receptor stimulation caused by organophosphate insecticides or chemical nerve agents (e.g., sarin and soman).

ONSET AND DURATION

Onset: Rapid
Duration: 2-6 hr

INDICATIONS

Hemodynamically significant bradycardia
Organophosphate or nerve gas poisoning

CONTRAINDICATIONS

Tachycardia
Hypersensitivity to atropine
Use with caution in patients with myocardial ischemia and hypoxia
Avoid in hypothermic bradycardia
Obstructive disease of gastrointestinal tract
Obstructive uropathy
Unstable cardiovascular status in acute hemorrhage with myocardial ischemia
Narrow-angle glaucoma
Thyrotoxicosis

ADVERSE REACTIONS

Tachycardia
Paradoxical bradycardia when pushed too slowly or when used at doses less than 0.5 mg
Palpitations
Dysrhythmias
Headache
Dizziness
Anticholinergic effects (dry mouth/nose/skin, photophobia, blurred vision, urinary retention, constipation)
Nausea and vomiting
Flushed, hot, dry skin
Allergic reactions

DRUG INTERACTIONS

Use with other anticholinergic agents may increase vagal blockade.
Potential adverse effects may occur when administered with digitalis, cholinergics, neostigmine.
The effects of atropine may be enhanced by antihistamines, procainamide, quinidine, antipsychotics and antidepressants, and thiazides.
Increased toxicity: amantadine

HOW SUPPLIED

Parenteral: There are various injection preparations.
In emergency care, atropine usually is supplied in prefilled syringes containing 1 mg in 10 mL of solution.

DOSAGE AND ADMINISTRATION

Bradydysrhythmia (With or Without ACS)
Adult: 0.5 mg every 3-5 min for desired response (max total dose: 3 mg); use shorter dosing intervals (3 min) and higher doses in severe clinical conditions
Pediatric: 0.02 mg/kg IV/IO; min dose: 0.1 mg; max single dose of 0.5 mg; may be repeated once; max total dose for a child: 1 mg; for adolescent: 3 mg; ET dose is 0.04-0.06 mg/kg
Anticholinesterase Poisoning
Adult: 1-2 mg IV push every 5-15 min until atropine effects are observed; then every 1-4 hr for at least 24 hr; extremely large doses (2-4 mg or more) may be needed
Pediatric: <12 years: 0.02-0.05 mg/kg/dose IV/IO; may be repeated every 20-30 min until muscarinic symptoms reverse; >12 years: 2 mg IV/IO; then 1-2 mg IV/IO every 20-30 min until muscarinic symptoms reverse
Rapid Sequence Intubation
0.01-0.02 mg/kg IV/IO; max single dose: 0.5 mg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Follow endotracheal tube administration with several positive pressure ventilations.
Atropine causes pupillary dilation, rendering the pupils nonreactive; pupil response may not be useful in monitoring central nervous system status.

CALCIUM CHLORIDE

CLASS

Electrolyte

DESCRIPTION

Calcium is an essential component for the functional integrity of the nervous and muscular systems, for normal cardiac contractility, and for the coagulation of blood. Calcium chloride contains 27.2% elemental calcium. Calcium chloride is a hypertonic solution and should be administered only IV (slowly, not exceeding 1 mL/min).

ONSET AND DURATION

Onset: 5-15 min
Duration: Dose-dependent (effects may persist for 4 hr after IV administration)

INDICATIONS

Hyperkalemia (except when associated with digitalis toxicity)
Hypocalcemia (e.g., after multiple blood transfusions)
Calcium channel blocker toxicity
Hypermagnesemia
To prevent hypotensive effects of calcium channel blocking agents (e.g., IV verapamil and diltiazem)

CONTRAINDICATIONS

Ventricular fibrillation during cardiac resuscitation
In patients with digitalis toxicity
Hypercalcemia

ADVERSE REACTIONS

Bradycardia (may cause asystole)
Hypotension
Metallic taste
Severe local necrosis and sloughing following intramuscular use or IV infiltration

DRUG INTERACTIONS

Calcium may worsen dysrhythmias caused by digitalis.
Calcium may antagonize the peripheral vasodilatory effects of calcium channel blockers.

HOW SUPPLIED

10% solution in 10-mL (100 mg/mL) ampules, vials, and prefilled syringes

DOSAGE AND ADMINISTRATION

Hyperkalemia and Calcium Channel Blocker Overdose
Adult: Typical dose is 500-1000 mg (5-10 mL of a 10% solution); may be repeated as needed
Pediatric: 20 mg/kg (0.2 mL/kg) IV of 10% solution slow IV/IO; may repeat if documented or clinical indication persists (e.g., toxicological problem); dose should not exceed adult dose

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Calcium may produce vasospasm in coronary and cerebral arteries.
Do not use routinely in cardiac arrest.
Hypertension and bradycardia may occur with rapid administration.
Monitor heart rate during administration.

NOTE
It is important to flush the IV line between administration of calcium chloride and sodium bicarbonate to avoid precipitation.

DEXAMETHASONE (DECADRON, HEXADROL, AND OTHERS)

CLASS

Glucocorticoid

DESCRIPTION

Dexamethasone is a synthetic steroid that is related chemically to the natural hormones secreted by the adrenal cortex. The drug suppresses acute and chronic inflammation, potentiates the relaxation of vascular and bronchial smooth muscle by beta-adrenergic agonists, and possibly alters airway hyperreactivity. In emergency care, dexamethasone generally is used in the treatment of allergic reactions and asthma and to reduce swelling in the central nervous system.

ONSET AND DURATION

Onset: 4-8 hr after parenteral administration
Duration: 24-72 hr

INDICATIONS

Endocrine, rheumatic, hematological disorders
Allergic states
Septic shock
Chronic inflammation

CONTRAINDICATIONS

Hypersensitivity to the product
Active untreated infections (relative)

ADVERSE REACTIONS

Decreased wound healing
Hypertension
Gastrointestinal bleeding
Hyperglycemia

DRUG INTERACTIONS

Barbiturates and phenytoin can decrease dexamethasone effects.

HOW SUPPLIED

Common preparations used in emergency care are for IV administration and are as follows:
4 mg/mL in 1-, 5-, 10-, 25-, 30-mL vials
10 mg/mL in 10-mL vials, 1-mL syringe, 1-mL ampule

20 mg/mL in 5-mL vials (IV or IM), 5-mL syringe (IV)
24 mg/mL (IV only) in 5- and 10-mL vials

DOSAGE AND ADMINISTRATION

Adult: There is considerable variance in recommended dexamethasone doses. The usual range in emergency care is 4-24 mg IV. Some physicians may prefer significantly higher doses (up to 100 mg) for unusual indications.
Pediatric: 1 dose of 0.6 mg/kg PO/IM/IV (max dose: 16 mg)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C; dexamethasone crosses the placenta and may cause fetal damage.
Medication should be protected from heat.
Because of onset of action (4-8 hr), dexamethasone should not be considered a first-line medication for allergic reactions.

DEXTROSE 50%

CLASS

Carbohydrate, hypertonic solution

DESCRIPTION

The term *dextrose* is used to describe the six-carbon sugar *D-glucose,* the principal form of carbohydrate used by the body. 50% dextrose solution is used in emergency care to treat hypoglycemia and in the management of coma of unknown origin.

ONSET AND DURATION

Onset: 1 min
Duration: Depends on the degree of hypoglycemia

INDICATIONS

Hypoglycemia (documented or strongly suspected)
Altered level of consciousness
Coma of unknown origin
Seizure of unknown origin

CONTRAINDICATIONS

Intracranial hemorrhage
Increased intracranial pressure
Known or suspected stroke in the absence of hypoglycemia

ADVERSE REACTIONS

Warmth, pain, burning from medication infusion, hyperglycemia, thrombophlebitis

DRUG INTERACTIONS

None significant

HOW SUPPLIED

25 g/50 mL prefilled syringe (500 mg/mL)

DOSAGE AND ADMINISTRATION

Adult: 12.5-25 g slow IV; may be repeated once
Pediatric: 0.5-1 g/kg IV/IO (max recommended concentration: 25%)
2-4 mL/kg 25%
5-10 mL/kg 10%
10-20 mL/kg 5% if volume tolerated

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Draw blood sample before administration if possible.
Perform blood glucose analysis before administration if possible.
Extravasation may cause tissue necrosis; use large vein and aspirate occasionally to ensure route patency.
50% dextrose solution sometimes may precipitate severe neurological symptoms (Wernicke's encephalopathy) in thiamine-deficient patients (for example, alcoholics). (This can be prevented by administering 100 mg of thiamine IV.)

DIAZEPAM (VALIUM AND OTHERS)

CLASS

Benzodiazepine

DESCRIPTION

Diazepam is a frequently prescribed medication to treat anxiety and stress. In emergency care, diazepam is used to treat alcohol withdrawal and grand mal seizure activity. Diazepam acts on the limbic, thalamic, and hypothalamic regions of the central nervous system to potentiate the effects of inhibitory neurotransmitters, raising the seizure threshold in the motor cortex. It also may be used in conscious patients during cardioversion and transcutaneous pacing to induce amnesia and sedation. Its use as an anticonvulsant may be short-lived because of rapid redistribution from the central nervous system. Rapid IV administration may be followed by respiratory depression and excessive sedation, particularly in elderly patients.

ONSET AND DURATION

Onset: (IV) 1-5 min; (IM) 15-30 min
Duration: (IV) 15 min-1 hr; (IM) 15 min-1 hr

INDICATIONS

Acute anxiety states
Acute alcohol withdrawal
Skeletal muscle relaxation
Seizure activity
Premedication before countershock or transcutaneous pacing

CONTRAINDICATIONS

Hypersensitivity to the drug
Substance abuse (use with caution)

Coma (unless the patient has seizures or severe muscle rigidity or myoclonus)
Shock
Central nervous system depression as a result of head injury
Respiratory depression

ADVERSE REACTIONS

Hypotension
Reflex tachycardia (rare)
Respiratory depression
Ataxia
Psychomotor impairment
Confusion
Nausea
Dizziness
Drowsiness
Blurred vision

DRUG INTERACTIONS

Diazepam may precipitate central nervous system depression and psychomotor impairment when the patient is taking other central nervous system depressant medications.
Diazepam should not be administered with other drugs because of possible precipitation (incompatible with most fluids; should be administered into an IV of NS solution).

HOW SUPPLIED

Parenteral: 5 mg/mL vials, ampules, Tubex

DOSAGE AND ADMINISTRATION

Seizure Activity
Adult: 5 mg over 2 min (up to 10 mg for most adults) IV q 10-15 min prn (max dose: 30 mg)
Pediatric: Dose for infants 30 days to 5 yr is 0.2-0.5 mg slow IV q 2-5 min to max 5 mg; children 5 yr or older is 1 mg q 2-5 min to max 10 mg slow IV
Premedication for Cardioversion or Transcutaneous Pacing
Adult: 5-15 mg IV, 5-10 min before procedure
Rapid Sequence Intubation in Children
0.2-0.3 mg/kg IV/IO; max single dose 10 mg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D
Diazepam may cause local venous irritation.
Diazepam has short duration of anticonvulsant effect.
Reduce dose by 50% in elderly patients.
Rectal administration may require higher dose because absorption is incomplete.
Resuscitation equipment should be readily available.

DIGOXIN (LANOXIN)

CLASS

Cardiac glycoside, miscellaneous antidysrhythmic

DESCRIPTION

Digoxin (digitalis) is a cardiac glycoside derived primarily from the foxglove plant. Its primary action involves alteration of ion transport across cardiac cell membranes. Increased intracellular calcium improves myocardial contractility. Digoxin increases vagal tone and therefore indirectly decreases sinus node rate, reduces sympathetic tone, and decreases atrioventricular node conduction velocity (with an increase in atrioventricular node refractory period). Sodium pumped out of cells may cause increased automaticity.

ONSET AND DURATION

Onset: (IV) 5-30 min
Duration: 3-4 days

INDICATIONS (MAY BE OF LIMITED USE)

Supraventricular tachycardias, especially atrial flutter and atrial fibrillation
Alternative drug for reentry SVT

CONTRAINDICATIONS

Ventricular fibrillation
Ventricular tachycardia
Atrioventricular block
Digitalis toxicity
Hypersensitivity to digoxin
Second- or third-degree heart block in the absence of artificial pacing

ADVERSE REACTIONS (MOSTLY RELATED TO DIGITALIS TOXICITY)

Headache
Weakness
Visual disturbances (blurred, yellow or green vision)
Confusion
Seizures
Dysrhythmias (virtually any disturbance, but junctional tachycardias are most common)
Nausea and vomiting
Skin rash
Hypotension

DRUG INTERACTIONS

Amiodarone, verapamil, and quinidine may increase serum digoxin concentrations by 50% to 70%.
Concurrent administration of IV digoxin and IV verapamil may lead to severe heart block.
Erythromycin and tetracycline may increase serum digoxin concentrations by reducing hepatic breakdown.
Diuretics may potentiate digoxin cardiotoxicity via loss of potassium.

Sympathomimetics may augment the inotropic and cardiotoxic effects of digoxin.
Concomitant administration of kaolin, pectin, and antacids may reduce digoxin absorption from the gastrointestinal tract.

HOW SUPPLIED

In emergency care, the common form of digoxin is supplied in 2-mL ampules, containing 0.5 mg of the drug (0.25 mg/mL)

DOSAGE AND ADMINISTRATION

Adult: Loading dose 0.004-0.006 mg/kg (4-6 mcg/kg) initially over 5 min; second and third boluses of 0.002-0.003 mg/kg (2-3 mcg/kg) to follow at 4-8 hr intervals (total loading dose 8-12 mcg/kg divided over 8-16 hr); maintenance dose affected by body mass and renal function
Pediatric: Not recommended in prehospital setting

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Patient should be monitored constantly for signs of digitalis toxicity.
Patients with myocardial infarction and/or renal failure are prone to developing digitalis toxicity.
Digitalis toxicity is potentiated in patients with hypokalemia, hypomagnesemia, and hypercalcemia.
Avoid use in patients with Wolff-Parkinson-White syndrome because of possible ventricular dysrhythmias.
Avoid electrical cardioversion if patient is receiving digoxin unless condition is life threatening; use lower dose (10-20 J).
Reduce dose by 50% when used with amiodarone.

DIGOXIN IMMUNE FAB (DIGIBIND, DIGIFAB)

CLASS

Biologic response modifier; antidote

DESCRIPTION

Digoxin immune Fab (ovine) is a protein that consists of antibody fragments, which are used as an antidote for digitalis toxicity. Molecules of digoxin or digitoxin are removed from tissue binding sites and are sequestered in the extracellular fluid, shifting equilibrium away from binding of the drug to its tissue receptors.[2]

ONSET AND DURATION

Onset: Within minutes
Duration: Dose-dependent

INDICATIONS

Digoxin toxicity with:
Life-threatening dysrhythmias
Shock or congestive heart failure
Hyperkalemia (potassium level >5 mEq/L)

CONTRAINDICATIONS

Ovine protein hypersensitivity
Use with caution in patients with renal failure or renal impairment.

ADVERSE REACTIONS

Anaphylaxis
Atrial fibrillation
Heart failure
Hypokalemia
Hypotension
Injection site reaction
Phlebitis

DRUG INTERACTIONS

None known

HOW SUPPLIED

38 mg (Digibind) and 40 mg (DigiFab) powder for IV injection

DOSAGE AND ADMINISTRATION

Adults and children: Dose varies according to amount of digoxin ingested. (Each vial binds about 0.5 mg of digoxin.) Average dose is 10 vials (400 mg); may require up to 20 vials (800 mg). For chronic intoxication 3-5 vials may be effective. Monitor children for volume overload.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Visually inspect parenteral products for particulate matter and discoloration before administration whenever solution and container permit.
Closely monitor the patient's temperature, blood pressure, and ECG.

DILTIAZEM (CARDIZEM) INJECTABLE

CLASS

Calcium channel blocker or calcium channel antagonist

DESCRIPTION

Diltiazem is a calcium channel blocking agent that slows conduction, increases refractoriness in the atrioventricular node, and causes coronary and peripheral vasodilation. The drug is used to control ventricular response rates in patients with atrial fibrillation or flutter, multifocal atrial tachycardias. Use after adenosine to treat refractory reentry SVT in patients with narrow QRS complex and adequate blood pressure.

ONSET AND DURATION

Onset: 2-5 min
Duration: 1-3 hr

INDICATIONS

To control ventricular rate in atrial fibrillation and atrial flutter
Multifocal atrial tachycardias
Paroxysmal supraventricular tachycardia

CONTRAINDICATIONS

Wide QRS tachycardias of unknown origin or poison/drug-induced tachycardia
Sick sinus syndrome
Second- or third-degree atrioventricular block (except with a functioning pacemaker)
Hypotension (less than 90 mm Hg)
Cardiogenic shock
Hypersensitivity to diltiazem
Rapid atrial fibrillation or atrial flutter associated with Wolff-Parkinson-White syndrome or a short P-R interval syndrome
Ventricular tachycardia
Acute myocardial infarction

ADVERSE REACTIONS

Atrial flutter
First- and second-degree atrioventricular block
Bradycardia
Hypotension
Chest pain
Congestive heart failure
Peripheral edema
Syncope
Ventricular dysrhythmias
Sweating
Nausea and vomiting
Dizziness
Dry mouth
Dyspnea
Headache
Rash

DRUG INTERACTIONS

Caution is warranted in patients receiving medications that affect cardiac contractility and/or sinoatrial or atrioventricular node conduction.
Diltiazem is incompatible with simultaneous furosemide injection.

HOW SUPPLIED

25 mg (5-mL vial); 50 mg (10-mL vial)

DOSAGE AND ADMINISTRATION

Acute rate control: 0.25 mg/kg (15-20 mg for the average patient) IV over 2 min; may be repeated in 15 min (0.35 mg/kg; 20-25 mg for the average patient) IV over 2 min
Maintenance infusion: Dilute 125 mg (25 mL) in 100 mL of solution (NS or D_5W); infuse 5-15 mg/hr, titrated to heart rate
Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Use with caution in patients with impaired renal or hepatic function.
Hypotension occasionally may result (more common with verapamil); carefully monitor vital signs.
Concurrent IV administration with IV beta blockers can cause severe hypotension and AV block. Use caution in patients taking oral beta blockers.
Premature ventricular contractions may be present on conversion of paroxysmal supraventricular tachycardia to sinus rhythm.
Shelf-life at room temperature is 1 month.

DIPHENHYDRAMINE (BENADRYL)

CLASS

Antihistamine

DESCRIPTION

Antihistamines prevent the physiological actions of histamine by blocking H_1 (e.g., diphenhydramine and cimetidine) and H_2 (e.g., cimetidine, ranitidine, and famotidine) receptor sites. Antihistamines are indicated for conditions in which histamine excess is present (e.g., acute urticaria) and are used as adjunctive therapy (with epinephrine, for example) in the treatment of anaphylactic shock. Antihistamines also are effective in the treatment of certain extrapyramidal (dystonic) reactions and for relief of upper respiratory tract and sinus symptoms associated with allergic reactions.

ONSET AND DURATION

Onset: Max effects 1-3 hr
Duration: 6-12 hr

INDICATIONS

Moderate to severe allergic reactions (after epinephrine)
Anaphylaxis
Acute extrapyramidal (dystonic) reactions

CONTRAINDICATIONS

Patients taking non-selective MAO inhibitors
Hypersensitivity
Narrow-angle glaucoma (relative)
Newborns and nursing mothers

ADVERSE REACTIONS

Dose-related drowsiness
Disturbed coordination

Hypotension
Palpitations
Tachycardia, bradycardia
Thickening of bronchial secretions
Dry mouth and throat
Paradoxical excitement in children

DRUG INTERACTIONS

Central nervous system depressants may increase depressant effects.
MAO inhibitors may prolong and intensify anticholinergic effects of antihistamines.

HOW SUPPLIED

Parenteral: 10 and 50 mg/mL vials, prefilled syringe

DOSAGE AND ADMINISTRATION

Adult: The standard dose of diphenhydramine is 10-50 mg IM, slow IV q 6-8 hr (max: 400 mg/day)
Pediatric (greater than 10 kg): 1.25 mg/kg/dose q 6 hr (max: 300 mg/day)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Use cautiously in patients with central nervous system depression or lower respiratory tract diseases such as asthma.

DOBUTAMINE (DOBUTREX)

CLASS

Sympathomimetic

DESCRIPTION

Dobutamine is a synthetic catecholamine that primarily stimulates $beta_1$-adrenergic receptors, and has much less significant effects on $beta_2$- and alpha-adrenergic receptors. The clinical effects of this drug include positive inotropic effects with minimal changes in chronotropic activity or systemic vascular resistance. For these reasons, dobutamine is useful in the management of congestive heart failure when an increase in heart rate is not desired.

ONSET AND DURATION

Onset: 1-2 min; peak after 10 min
Duration: 10-15 min

INDICATIONS

Pump problems (CHF, pulmonary congestion) with SBP of 70-100 mm Hg and *no* signs of shock

CONTRAINDICATIONS

Tachydysrhythmias (atrial fibrillation, atrial flutter)
Severe hypotension with signs of shock
Idiopathic hypertrophic subaortic stenosis
Suspected or known drug-induced shock

ADVERSE REACTIONS

Anxiety
Headache
Nausea
Fluctuations in blood pressure
Dose-related tachydysrhythmias
Hypertension
Ventricular ectopy

DRUG INTERACTIONS

Beta-adrenergic antagonists may blunt inotropic responses.
Sympathomimetics and phosphodiesterase inhibitors may exacerbate dysrhythmia responses.
Dobutamine is incompatible with sodium bicarbonate and furosemide in same IV line; it may be given in separate IV lines.

HOW SUPPLIED

12.5 mg/mL injectable

DOSAGE AND ADMINISTRATION

Adult: Usual dose is 2-20 mcg/kg/min IV, based on inotropic effect; titrate so heart rate does not increase by >10% of baseline
Pediatric: 2-20 mcg/kg/min IV/IO, titrated to desired effect

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Administer via an infusion pump to ensure precise flow rates.
Blood pressure should be monitored closely; hemodynamic monitoring is recommended for optimal use.
Dobutamine may be administered through a Y-site with concurrent dopamine, lidocaine, nitroprusside, and potassium chloride infusions; do not mix with sodium bicarbonate.
Increases in heart rate of more than 10% may induce or exacerbate myocardial ischemia.
Lidocaine should be readily available.
Correct hypovolemia before using dobutamine in hypotensive patients.
Elderly patients may have significantly decreased responses.

DOPAMINE (INTROPIN)

CLASS

Sympathomimetic

DESCRIPTION

Dopamine is related chemically to epinephrine and norepinephrine. It acts primarily on $alpha_1$- and $beta_1$-adrenergic receptors in a dose-dependent fashion. At moderate doses ("cardiac doses"), dopamine stimulates beta-adrenergic receptors, causing enhanced myocardial contractility, increased cardiac output, and a rise in blood pressure. At

high doses ("vasopressor doses"), dopamine has an alpha-adrenergic effect, producing peripheral arterial and venous constriction. Dopamine is a second-line drug for symptomatic bradycardia (after atropine). It commonly is used in the treatment of hypotension (SBP <70-100 mm Hg) with signs and symptoms of shock.

ONSET AND DURATION

Onset: 2-4 min
Duration: 10-15 min

INDICATIONS

Hemodynamically significant hypotension in the absence of hypovolemia
Symptomatic bradycardia (second-line drug after atropine)

CONTRAINDICATIONS

Tachydysrhythmias
Ventricular fibrillation
Patients with pheochromocytoma

ADVERSE REACTIONS

Dose-related tachydysrhythmias
Hypertension
Increased myocardial oxygen demand (e.g., ischemia)
Headache
Anxiety
Nausea and vomiting

DRUG INTERACTIONS

Dopamine may be deactivated by alkaline solutions (sodium bicarbonate and furosemide).
MAO inhibitors may potentiate the effect of dopamine.
Sympathomimetics and phosphodiesterase inhibitors exacerbate dysrhythmia response.
Beta-adrenergic antagonists may blunt inotropic response.
When administered with phenytoin, hypotension, bradycardia, and seizures may develop.

HOW SUPPLIED

200, 400, 800 mg in 5-mL prefilled syringe and ampule for IV infusion (IV piggyback)

DOSAGE AND ADMINISTRATION

Adult: Usual infusion rate 2-20 mcg/kg/min; titrate to response; taper slowly
Pediatric: 2-20 mcg/kg/min IV/IO, titrated to patient response (not to exceed 20 mcg/kg/min); if infusion dose >20 mcg/kg/min is required, consider alternative adrenergic agent (e.g., epinephrine/norepinephrine)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Infuse through large, stable vein to avoid the possibility of extravasation injury.
Use infusion pump to ensure precise flow rates.
Monitor patient for signs of compromised circulation.
Correct hypovolemia before using dopamine in hypotensive patients.
Do not mix with sodium bicarbonate.

EPINEPHRINE (ADRENALIN)

CLASS

Sympathomimetic

DESCRIPTION

Epinephrine is an endogenous catecholamine that directly stimulates alpha-, $beta_1$-, and $beta_2$-adrenergic receptors in dose-related fashion. Epinephrine is the initial drug of choice for treating bronchoconstriction and hypotension resulting from anaphylaxis and all forms of cardiac arrest. Epinephrine is useful in the management of reactive airway disease, but beta-adrenergic agents usually are considered the drugs of choice because they are inhaled and have fewer side effects. Rapid injection produces a rapid increase in blood pressure, ventricular contractility, and heart rate. In addition, epinephrine causes vasoconstriction in the arterioles of the skin, mucosa, and splanchnic areas, and antagonizes the effects of histamine.

ONSET AND DURATION

Onset: (subQ) 5-10 min; (IV/endotracheal tube) 1-2 min
Duration: 5-10 min

INDICATIONS

Acute allergic reaction (anaphylaxis)
Cardiac arrest
Pulseless electrical activity
Ventricular fibrillation and pulseless ventricular tachycardia unresponsive to initial defibrillation
Symptomatic bradycardia
Severe hypotension accompanied by bradycardia when pacing and atropine fail
Bronchial asthma

CONTRAINDICATIONS

Hypersensitivity (not an issue especially in emergencies—the dose should be lowered or given slowly in non–cardiac arrest patients with heart disease)
Hypovolemic shock (as with other catecholamines, correct hypovolemia before use)
Coronary insufficiency (use with caution)

ADVERSE REACTIONS

Headache
Nausea and vomiting
Restlessness
Weakness
Dysrhythmias, including ventricular tachycardia and ventricular fibrillation
Hypertension
Precipitation of angina pectoris

Tachycardia
Tremors
Dyspnea

DRUG INTERACTIONS

MAO inhibitors may potentiate the effect of epinephrine.
Beta-adrenergic antagonists may blunt inotropic response.
Sympathomimetics and phosphodiesterase inhibitors may exacerbate dysrhythmia response.
May be deactivated by alkaline solutions (sodium bicarbonate, furosemide).

HOW SUPPLIED

Parenteral: 1 mg/mL (1:1000), 0.1 mg/mL (1:10,000) ampule and prefilled syringe
Autoinjector (EpiPen): 0.3 mg/mL (1:2000)

DOSAGE AND ADMINISTRATION

Profound Bradycardia or Hypotension
Adult: 2-10 mcg/min infusion; titrate to patient response
Pediatric: All IV/IO doses: 0.01 mg/kg (1:10,000, 0.1 mL/kg); continuous infusion: 0.1-1 mcg/kg/min; higher doses may be effective
All ET doses: 0.1 mg/kg (0.1 mL/kg of 1:1000)
Pulseless Arrest
Adult:[1]
IV/IO dose: 1 mg (10 mL, 1:10,000) IV/IO push or endotracheal tube (2-2.5 mg diluted in 10 mL of NS), repeated every 3-5 min during resuscitation (follow each IV dose with a 20-mL saline flush); elevate arm for 20-30 sec after dose; higher doses (up to 0.2 mg/kg) may be used for specific indications (e.g., beta-blocker or calcium channel blocker overdose; poison/drug-induced shock)
Pediatric:
IV/IO dose: 0.01 mg/kg (1:10,000, 0.1 mL/kg) every 3-5 min during arrest; max dose: 1 mg
All ET doses: 0.1 mg/kg of 1:1000 (0.1 mL/kg) every 5 min of arrest until IV/IO access; then begin with first IV/IO dose
Continuous Infusions for Pulseless Arrest
Adult: Add 1 mg of epinephrine (1 mL of 1:1000 solution) to 500 mL of NS or D_5W; initial infusion rate of 0.1-0.5 mcg/kg/min; titrate to response
Anaphylactic Reaction or Bronchoconstriction
Adult:
Mild: 0.3-0.5 mL (1:1000) IM/subQ; repeat in 15-20 min if needed
Severe: 1 mL (1:10,000) slow IV over 5 min; IV infusion at rates of 1-4 mcg/min may prevent the need to repeat epinephrine injections frequently
Pediatric: Severe: 0.01 mg/kg (0.01 mL/kg of 1:1000) IM; max single dose: 0.3 mg; repeat as needed

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Do not use prefilled syringes for epinephrine infusions.
Syncope has occurred following epinephrine administration to asthmatic children.
Epinephrine may increase myocardial oxygen demand.

NOTE

Complications of IV administration of epinephrine are significant and include the development of uncontrolled systolic hypertension, vomiting, seizures, dysrhythmias, and myocardial ischemia. This route should be used only in patients with a critical life-threatening condition. Intravenous administration of epinephrine rarely is performed in conscious patients. Intravenous administration is performed with extreme caution in rare circumstances and only with authorization from medical direction. *Epinephrine 1:1000 should never be given as an IV bolus.*

EPINEPHRINE RACEMIC (MICRONEFRIN)

CLASS

Sympathomimetic

DESCRIPTION

As with other forms of epinephrine, racemic epinephrine acts as a bronchodilator that stimulates $beta_2$ receptors in the lungs, resulting in relaxation of bronchial smooth muscle. This alleviates bronchospasm, increases vital capacity, and reduces airway resistance. Racemic epinephrine is also useful in treating laryngeal edema. Racemic epinephrine also inhibits the release of histamine.

ONSET AND DURATION

Onset: Within 5 min
Duration: 1-3 hr

INDICATIONS

Bronchial asthma
Treatment of bronchospasm
Croup (laryngotracheobronchitis)
Laryngeal edema

CONTRAINDICATIONS

Hypertension
Underlying cardiovascular disease
Epiglottitis

ADVERSE REACTIONS

Tachycardia
Dysrhythmias

DRUG INTERACTIONS

MAO inhibitors may potentiate the effect of epinephrine.
Beta-adrenergic antagonists may blunt the bronchodilating response.

Sympathomimetics and phosphodiesterase inhibitors may exacerbate dysrhythmia response.

HOW SUPPLIED

Metered-dose inhaler: 0.16-0.25 mg/spray
Solution: 7.5, 15, 30 mL in 1%, 2.25% solution

DOSAGE AND ADMINISTRATION

Metered-Dose Inhaler
Adult: 2-3 inhalations, repeat once in 5 min prn
Solution
Adult: Dilute 5 mL (1%) in 5 mL of saline, administer over 15 min
Pediatric: Dilute 0.25 mL (0.1%) in 2.5 mL of saline (if less than 20 kg); 0.5 mL in 2.5 mL of saline (if 20-40 kg); 0.75 mL in 2.5 mL of saline (if greater than 40 kg); administer by aerosolization

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Racemic epinephrine may produce tachycardia and other dysrhythmias.
Monitor vital signs closely.
Excessive use may cause bronchospasm.
Rebound exacerbation of severe croup may occur following drug administration.

EPTIFIBATIDE (INTEGRILIN)

CLASS

Glycoprotein IIb/IIIa inhibitor

DESCRIPTION

Glycoprotein IIb/IIIa inhibitors inhibit the integrin GP IIb/IIIa receptor in the membrane of the platelets. As a result, they inhibit the common final pathway activation of platelet aggregation.

ONSET AND DURATION

Onset: Rapid
Duration: 30-45 min; platelet aggregation restored within 4 hr after infusion stopped

INDICATIONS

Eptifibatide (in combination with aspirin and heparin) is indicated for use in patients undergoing percutaneous coronary intervention (PCI) as well as for the treatment of unstable angina or non-STEMI myocardial infarction.

CONTRAINDICATIONS

Active internal bleeding
Bleeding disorder within the past 30 days
History of intracranial hemorrhage, neoplasm, AV malformation, aneurysm, or stroke within 30 days
Major surgical procedure or trauma within 1 month
Aortic dissection, pericarditis, and severe hypertension
Hypersensitivity to any GP IIb/IIIa inhibitor
Low platelet count

ADVERSE REACTIONS

Anaphylactoid reaction/anaphylactic shock
Bleeding
GI bleeding
Hematemesis
Hematuria
Hypotension
Intracranial bleeding
Platelet dysfunction
Retroperitoneal bleeding
Stroke
Thrombocytopenia

DRUG INTERACTIONS

Concomitant use of eptifibatide and other agents that may affect hemostasis, such as anticoagulants, other platelet inhibitors, NSAIDs, and thrombolytic agents, may be associated with an increased risk of bleeding.

HOW SUPPLIED

Solution: 0.75 mg/mL, 2.0 mg/mL

DOSAGE AND ADMINISTRATION (ADULTS)

Unstable angina and NSTEMI myocardial infarction (PCI): 180 mcg/kg IV (max: 22.6 mg) bolus over 1-2 min, followed by 2 mcg/kg/min (max: 15 mg/hr) continuous IV infusion; repeat bolus in 10 min. Decrease dose in patients with impaired renal function.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
Bleeding risk may be increased in patients receiving eptifibatide concomitantly with heparin, other anticoagulant therapy, or thrombolytics.
Eptifibatide should not be used in patients with renal failure and is contraindicated in patients with dependency on renal dialysis.
Elderly patients may be at increased risk for bleeding while receiving eptifibatide.

ESMOLOL (BREVIBLOC)

CLASS

Beta$_1$ blocker

DESCRIPTION

Esmolol is an extremely short-acting cardioselective beta blocker. Unlike other beta$_1$-selective beta blockers (e.g., metoprolol, atenolol), esmolol is administered via continuous IV infusion. It has a short duration of action, making it useful for acute control of hypertension or certain supraventricular dysrhythmias, such as sinus tachycardia, atrial flutter and/or fibrillation in the emergency setting. Nonapproved indications include short-term control of

perioperative hypertension, management of tachydysrhythmias complicating acute MI, and minimization of acute myocardial ischemia secondary to acute MI or unstable angina.

ONSET AND DURATION

Onset: Rapid
Duration: Less than 10 min

INDICATIONS

All patients with suspected MI and unstable angina in the absence of contraindications (can reduce the incidence of VF)
Useful as an adjunctive agent with fibrinolytic therapy (may reduce nonfatal reinfarction and recurrent ischemia)
To convert to normal sinus rhythm or to slow ventricular response (or both) in supraventricular tachydysrhythmias (reentry SVT, atrial fibrillation, or atrial flutter)
To reduce myocardial ischemia in AMI patients with elevated heart rate, blood pressure, or both

CONTRAINDICATIONS

Hemodynamically unstable patients
STEMI if signs of heart failure, low cardiac output, or increased risk for cardiogenic shock are present
Relative contraindications include P-R interval >0.24 sec, second- or third-degree heart block, active asthma, reactive airway disease, severe bradycardia, SBP <100 mm Hg

ADVERSE REACTIONS

Myocardial depression
AV block
Bradycardia
Cardiac arrest
Diaphoresis
Dizziness
Headache
Hyperglycemia
Hypoglycemia
Hypotension
Nausea
Vomiting

DRUG INTERACTIONS

A potentially clinically significant interaction between esmolol and digoxin may exist because of their additive effects on the AV node.
Esmolol can potentiate the suppressive effects of diltiazem and verapamil on AV nodal conduction.
Depression of AV nodal conduction and myocardial function are possible when used in combination with adenosine, disopyramide, or other antidysrhythmics or drugs, especially in patients with preexisting left ventricular dysfunction.
Careful titration of esmolol is prudent when given with morphine.

HOW SUPPLIED

Solution: 10 mg/mL; 20 mg/mL

DOSAGE AND ADMINISTRATION

0.5 mg/kg (500 mcg/kg) over 1 minute, followed by 0.05 mg/kg (50 mcg/kg) per minute infusion; maximum: 0.3 mg/kg (300 mcg/kg) per minute.
If inadequate response after 5 minutes, may repeat 0.5 mg/kg (500 mcg/kg) bolus and then titrate infusion up to 0.2 mg/kg (200 mcg/kg) per minute. Higher doses are unlikely to be beneficial.
Has a short half-life (2 to 9 minutes).

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Administration of esmolol can exacerbate Raynaud's disease or peripheral vascular disease.
Use with caution in patients with poorly controlled diabetes mellitus or renal disease.
Avoid extravasation of esmolol during intravenous administration. Sloughing of the skin and necrosis have been reported following infiltration and extravasation of IV esmolol infusions.

ETOMIDATE (AMIDATE)

CLASS

Nonbarbiturate hypnotic, anesthetic

DESCRIPTION

Etomidate is a short-acting drug that acts at the level of the reticular activating system to produce anesthesia. Etomidate may be administered for conscious sedation to relieve apprehension or impair memory before tracheal intubation or cardioversion.

ONSET AND DURATION

Onset: Less than 1 min
Duration: 5-10 min

INDICATIONS

Premedication for tracheal intubation or cardioversion

CONTRAINDICATIONS

Hypersensitivity to etomidate
Labor/delivery

ADVERSE REACTIONS

Nausea and vomiting
Dysrhythmias
Breathing difficulties
Hypotension
Hypertension
Involuntary muscle movement

Pain at injection site
Cortisol suppression

DRUG INTERACTIONS

Effects may be enhanced when given with other central nervous system depressants.

HOW SUPPLIED

2 mg/mL vials

DOSAGE AND ADMINISTRATION FOR RSI

Adult: 0.2-0.4 mg/kg IV over 30-60 sec; limit to 1 dose
Pediatric (>10 years of age): 0.2-0.4 mg/kg for sedation infused over 30-60 sec; max dose: 20 mg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Carefully monitor vital signs.
Etomidate can suppress adrenal gland production of steroid hormones, which can cause temporary gland failure.
Avoid routine use in patients suspected to have septic shock.

FENTANYL (SUBLIMAZE)

CLASS

Opioid analgesic

DESCRIPTION

Fentanyl (like other opioids) combines with receptor sites in the brain to produce potent analgesic effects. The drug often is given in combination with benzodiazepines for conscious sedation.

ONSET AND DURATION

Onset: 1-2 min (IV)
Duration: ½ to 1 hr

INDICATIONS

Pain control
Sedation for invasive airway procedures (e.g., rapid sequence induction)

CONTRAINDICATIONS

Respiratory depression
Hypotension
Head injury
Cardiac dysrhythmias
Myasthenia gravis
Hypersensitivity to opiates

ADVERSE REACTIONS

Respiratory depression
Bradycardia
Hypotension or hypertension
Nausea and vomiting
Chest wall muscle rigidity

DRUG INTERACTIONS

Effects may be increased when given with other central nervous system depressants or skeletal muscle relaxants.

HOW SUPPLIED

0.05-0.1 mg/mL ampules

DOSAGE AND ADMINISTRATION

Adult: 0.05-0.1 mg IV slow IV over 1-2 min every 1-2 hr as needed to control pain
Child: 1-2 mcg/kg; rarely used in the prehospital setting
Rapid Sequence Intubation
2-5 mcg/kg IV/IO

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Fentanyl is a schedule II drug with the potential for abuse.
Fentanyl should be used (if at all) with caution in elderly patients and in those with severe respiratory disorders, seizure disorders, cardiac disorders, or pregnancy.
Naloxone or nalmefene should be available to reverse respiratory depression.

FLUMAZENIL (ROMAZICON)

CLASS

Benzodiazepine receptor antagonist, antidote

DESCRIPTION

Flumazenil antagonizes the actions of benzodiazepines in the central nervous system. It has been shown to reverse sedation, impairment of recall, and psychomotor impairment produced by benzodiazepines. Flumazenil is not, however, as effective in reversing hypoventilation. Flumazenil does not antagonize central nervous system effects of ethanol, barbiturates, or opioids.

ONSET AND DURATION

Onset: 1-2 min
Duration: Related to plasma concentration of benzodiazepine

INDICATIONS

Reversal of respiratory depression and sedation from pure benzodiazepine overdose

CONTRAINDICATIONS

Hypersensitivity to flumazenil or to benzodiazepines
Tricyclic antidepressant overdose
Chronic benzodiazepine users or alcoholics
Cocaine or other stimulant intoxication
Known seizure disorder (relative)

ADVERSE REACTIONS

Nausea and vomiting
Dizziness
Headache
Agitation
Injection site pain
Cutaneous vasodilation
Abnormal vision
Seizures

DRUG INTERACTIONS

Toxic effects of mixed drug overdose (especially tricyclic antidepressants) may emerge with the reversal of the benzodiazepine effects.

HOW SUPPLIED

5- and 10-mL vials (0.1 mg/mL)

DOSAGE AND ADMINISTRATION

For Suspected Benzodiazepine Overdose
Adult:
First dose: 0.2 mg IV over 15 sec
Second dose: 0.3 mg IV over 30 sec
Third dose: 0.5 mg over 30 sec at 1-min intervals until adequate response or max dose of 3 mg is given
Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
To minimize the likelihood of injection site pain, administer through an IV infusion established in a large vein.
Be prepared to manage seizures in patients who are physically dependent on benzodiazepines to control seizures or who have ingested large doses of other drugs.
Flumazenil may precipitate withdrawal syndromes in patients who are dependent on benzodiazepines.
Patients should be monitored for possible resedation, respiratory depression, or other residual benzodiazepine effects.
Be prepared to establish and assist ventilation.

FUROSEMIDE (LASIX)

CLASS

Loop diuretic

DESCRIPTION

Furosemide is a potent diuretic that inhibits the reabsorption of sodium and chloride in the proximal tubule and loop of Henle. Intravenous doses also can reduce cardiac preload by increasing venous capacitance.

ONSET AND DURATION

Onset: (IV) Diuretic effects within 15-20 min; vascular effects within 5 min
Duration: 2 hr

INDICATIONS

Acute pulmonary edema in patients with a SBP >90-100 mm Hg (without signs and symptoms of shock)
Hypertensive emergencies
Hyperkalemia

CONTRAINDICATIONS

Anuria (though loop diuretics can be used in patients with reduced creatinine clearance)
Hypersensitivity
Hypovolemia/dehydration
Known hypersensitivity to sulfonamides (caution)
Severe electrolyte depletion (hypokalemia)

ADVERSE REACTIONS

Hypotension
Electrocardiogram changes associated with electrolyte disturbances
Dry mouth
Hypochloremia
Hypokalemia
Hyponatremia
Hypocalcemia
Hyperglycemia
Hearing loss can occur rarely after too rapid infusion of large doses especially in patients with renal impairment.

DRUG INTERACTIONS

Digitalis toxicity may be potentiated because of potassium depletion, which can result from furosemide administration.
Furosemide increases ototoxic potential of aminoglycoside antibiotics.
Lithium toxicity may be potentiated because of sodium depletion.
Furosemide may potentiate therapeutic effect of other antihypertensive drugs.

HOW SUPPLIED

Parenteral: 10 mg/mL in 2-, 4-, 8-mL ampule, 10 mg/mL in 10-mL vial

DOSAGE AND ADMINISTRATION

IV: 0.5-1 mg/kg over 1-2 min; if no response, double dose to 2 mg/kg given slowly over 1-2 min; for new-onset pulmonary edema with hypovolemia, give <0.5 mg/kg
Pediatric: 1 mg/kg/dose (max total dose: 6 mg/kg)
Hyperkalemia (adult): 40-80 mg IV

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Furosemide has been known to cause fetal abnormalities.
Furosemide should be protected from light and stored at room temperature; do not use if solution is discolored or yellow.

GLUCAGON

CLASS

Pancreatic hormone, antihypoglycemic agent

DESCRIPTION

Glucagon is a protein secreted by the alpha cells of the pancreas. When released, glucagon results in blood glucose elevation by increasing the breakdown of glycogen to glucose (glycogenolysis) and stimulating glucose synthesis (gluconeogenesis). The drug is only effective in treating hypoglycemia if liver glycogen is available and therefore may be ineffective in chronic states of hypoglycemia, starvation, and adrenal insufficiency. In addition, glucagon exerts positive inotropic action on the heart and decreases renal vascular resistance. For this reason, glucagon also is used in managing patients with beta-blocker and calcium channel blocker cardiotoxicity who do not respond to saline infusions or other conventional therapy.

ONSET AND DURATION

Onset: Within 1 min
Duration: 60-90 min

INDICATIONS

Hypoglycemia
Calcium channel blocker or beta-blocker toxicity

CONTRAINDICATIONS

Hypersensitivity (allergy to proteins)

ADVERSE REACTIONS

Tachycardia
Hypotension
Nausea and vomiting
Urticaria

DRUG INTERACTIONS

Effect of anticoagulants may be increased if given with glucagon.
Do not mix with saline.

HOW SUPPLIED

Glucagon must be reconstituted (with provided diluent) before administration. Dilute 1 unit (1 mg) of white powder in 1 mL of diluting solution (1 mg/mL).

DOSAGE AND ADMINISTRATION

Hypoglycemia
Adult: 0.5-1 mg IM; may repeat in 7-10 min
Pediatric: For >20 kg, 0.5-1 mg IM
Calcium Channel Blocker or Beta-Blocker Toxicity
Adult: 3-10 mg slow IV over 3-5 min, followed by infusion at 3-5 mg/hr
Pediatric: Safety and efficacy have not been established.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
Glucagon should not be considered a first-line choice for hypoglycemia.
May cause vomiting and hyperglycemia.
Intravenous glucose will need to be administered if the patient does not respond to a second dose of glucagon.
Do not use the provided diluent to mix continuous infusions.

HALOPERIDOL LACTATE (HALDOL)

CLASS

Antipsychotic/neuroleptic

DESCRIPTION

Haloperidol has pharmacological properties similar to those of the phenothiazines. The drug is thought to block dopamine (type 2) receptors in the brain, altering mood and behavior. In emergency care, haloperidol usually is administered IM.

ONSET AND DURATION

Onset: (IM) 30-60 min
Duration: 12-24 hr

INDICATIONS

Acute psychotic episodes
Emergency sedation of severely agitated or delirious patients

CONTRAINDICATIONS

Central nervous system depression
Coma
Hypersensitivity
Pregnancy
Severe liver or cardiac disease

ADVERSE REACTIONS

Dose-related extrapyramidal reactions:
Pseudoparkinsonism
Akathisia
Dystonias
Hypotension
Orthostatic hypotension
Nausea, vomiting
Allergic reactions
Blurred vision
Drowsiness

DRUG INTERACTIONS

Other central nervous system depressants may potentiate effects.
Haloperidol may inhibit vasoconstrictor effects of epinephrine.

HOW SUPPLIED

5 mg/mL

DOSAGE AND ADMINISTRATION

Adult: 2-5 mg IM every 4-8 hr as needed
Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

HEPARIN

Low Molecular Weight Heparin (Enoxaparin)

CLASS

Anticoagulant

DESCRIPTION

Heparin is available as Low Molecular Weight Heparin (LMWH [Enoxaparin]) and Unfractionated Heparin (UFH). Both inhibit the clotting cascade by activating specific plasma proteins. Natural heparin (heparin sodium) consists of molecular chains of varying lengths or *molecular weights*. LMWHs consist of only short chains of molecular weight and produce a more predictable coagulation response than UFH.[2] The use of LMWH has been approved for both the prevention and treatment of acute deep vein thrombosis, acute pulmonary embolism, and for the treatment of acute coronary syndromes.

ONSET AND DURATION

Onset: (IV) Immediate
(SQ) 20-60 min
Duration: 4-8 hr

INDICATIONS

ACS,
Acute deep vein thrombosis
Acute pulmonary embolism

CONTRAINDICATIONS

Same as for fibrinolytic therapy
Renal insufficiency
Active bleeding or low platelet count
Hypersensitivity to heparin or pork products
Recent intracranial, intraspinal, or eye surgery
Severe hypertension
Heparin-induced thrombocytopenia

ADVERSE REACTIONS

Allergic reaction (chills, fever, back pain)
Thrombocytopenia
Hemorrhage
Bruising
Rash

DRUG INTERACTIONS

None noted
Salicylates, ibuprofen, dipyridamole, and hydroxychloroquine may increase risk of bleeding.

HOW SUPPLIED

Concentrations range from 30 mg to 150 mg in various mL of solution for SQ or IV administration

DOSAGE AND ADMINISTRATION

STEMI Protocol
- Age <75 years: initial bolus 30 mg IV with second bolus 15 min later of 1 mg/kg SQ (max 100 mg dose for first 2 doses).
- Age ≥75 years: Eliminate initial IV bolus; give 0.75 mg/kg SQ every 12 hours (max 75 mg dose for first 2 doses).

Should use UFH if early cardiac catheterization (within 12 hours) is planned.
UA/NSTEMI Protocol
Loading dose: 30 mg IV bolus; maintenance dose 1 mg/kg SQ every 12 hours.
Deep Vein Thrombosis (DVT) or Pulmonary Embolism Protocol
Adults: 1 mg/kg SQ every 12 hours or 1.5 mg/kg SC every 24 hours.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
The platelet count should be monitored in patients receiving enoxaparin.
Always follow institutional protocol regarding heparin administration.
Multiple-dose vials of enoxaparin contain benzyl alcohol (1.5%) as a preservative and should be avoided in patients with benzyl alcohol hypersensitivity.
Do not administer IM.
Enoxaparin cannot be used interchangeably (unit for unit) with heparin sodium or other low molecular weight heparins.
Do not mix with other products or infusion fluids.

HEPARIN SODIUM

Unfractionated (UFH)

CLASS

Anticoagulant

DESCRIPTION

Heparin inhibits the clotting cascade by activating specific plasma proteins. The drug is used in the prevention and treatment of all types of thromboses and emboli, disseminated intravascular coagulation, arterial occlusion, and thrombophlebitis and is used prophylactically to prevent clotting before surgery. Heparin is considered part of the antithrombotic package (along with aspirin and fibrinolytic agents) administered to patients

with STEMI, UA/NSTEMI, and acute coronary syndromes.

ONSET AND DURATION

Onset: (IV) Immediate
(SQ) 20-60 min
Duration: 4-8 hr

INDICATIONS

Acute myocardial infarction
UA/NSTEMI
STEMI
Prophylaxis and treatment of thromboembolic disorders (e.g., pulmonary emboli and deep venous thrombosis)

CONTRAINDICATIONS

Same as for fibrinolytic therapy
Hypersensitivity
Active bleeding
Recent intracranial, intraspinal, or eye surgery
Severe hypertension
Bleeding tendencies
Severe thrombocytopenia

ADVERSE REACTIONS

Allergic reaction (chills, fever, back pain)
Thrombocytopenia
Hemorrhage
Bruising
Rash

DRUG INTERACTIONS

Salicylates, ibuprofen, dipyridamole, and hydroxychloroquine may increase risk of bleeding.

HOW SUPPLIED

Concentrations range from 1000 to 40 000 units/mL

DOSAGE AND ADMINISTRATION

IV Infusion- STEMI and UA/NSTEMI
Initial bolus of 60 units/kg (max bolus: 4000 units); continue 12 units/kg/hr, round to the nearest 50 units (max initial rate: 1000 units/hr).

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Dosing should be guided by laboratory analysis of platelet count and partial thromboplastin time. Always follow institutional protocol regarding heparin administration.

HYDROMORPHONE (DILAUDID)

CLASS

Analgesic; opiate agonist

DESCRIPTION

Hydromorphone is a semisynthetic analog of morphine used to relieve moderate to severe pain in cancer, surgery, trauma, burn, and cardiac patients. The drug works at opioid receptors to produce analgesia and euphoria. It may also produce respiratory depression, miosis, decreased gastrointestinal motility, and physical dependence. Hydromorphone is a schedule II controlled substance.

ONSET AND DURATION

Onset (IV/IM): Within 15 min (dose related)
Duration: 4-5 hr in nondependent patients

INDICATIONS

Moderate to severe pain
Analgesia
Preoperative medication

CONTRAINDICATIONS

Asthma
GI obstruction
Hypersensitivity to narcotics
Ileus
Respiratory depression
Status asthmaticus

ADVERSE REACTIONS

Respiratory depression
Nausea and vomiting
Euphoria
Delirium
Agitation
Hallucination
Seizures
Headache
Hypotension
Visual disturbances
Coma
Facial flushing
Circulatory collapse
Dysrhythmias
Allergic reaction
Drowsiness
Rash

DRUG INTERACTIONS

Respiratory depression, hypotension, or sedation may be potentiated by central nervous system depressants.
Therapeutic doses of hydromorphone have caused additive CNS or respiratory depression and hypotension in patients taking MAO inhibitors.

HOW SUPPLIED

Solution for injection: 1 mg/mL, 2 mg/mL, 4 mg/mL

DOSAGE AND ADMINISTRATION

Adult: 1-2 mg subQ/IM or slow IV every 6 hr; titrate to pain relief
Pediatric (>50 kg): 1 mg IV/subQ every 4 hr; pediatric (<50 kg or >6 months of age): 0.015-0.02 mg/kg IV/subQ every 2-4 hr; titrate to pain relief

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
High potential for abuse
Use with extreme caution in patients with head trauma, increased intracranial pressure (ICP), or a preexisting seizure disorder.
Use with caution in patients with cardiac dysrhythmias, hypotension, circulatory shock, or hypovolemia.
Elderly patients may be more susceptible to adverse reactions.
Can induce vasovagal syncope or orthostatic hypotension.
Naloxone should be readily available.

HYDROXOCOBALAMIN (CYANOKIT)

CLASS

Vitamin; antidote

DESCRIPTION

Hydroxocobalamin is a parenteral preparation of vitamin B_{12}; specifically, it is the hydroxylated active form of vitamin B_{12}. Hydroxocobalamin is used to treat known or suspected cyanide toxicity.

ONSET AND DURATION

Onset: Rapid
Duration: Greater than 24 hr

INDICATIONS

Known or suspected cyanide poisoning

CONTRAINDICATIONS

Known hydroxocobalamin hypersensitivity

ADVERSE REACTIONS

Allergic reaction/anaphylaxis
Elevated blood pressure
Headache
Hypertension
Injection site reaction
Nausea
Photophobia
Red-colored urine

DRUG INTERACTIONS

None

HOW SUPPLIED

Powder for injection: 5 g
Solution: 1000 mcg/mL

DOSAGE AND ADMINISTRATION

Adults: Initially, 5 g (two 2.5-g vials) IV infused over 15 min (approximately 15 mL/min or 7.5 min per vial). A second 5-g dose infused over 15 min to 2 hr (depending on patient status), for a total of 10 g, may be administered based on clinical response and severity of cyanide poisoning
Children: Doses of 70 mg/kg IV have been used; not FDA approved

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Before administration of the antidote, a blood sample should be taken to determine the cyanide concentration.
Treatment of cyanide poisoning includes supportive therapy, such as cardiovascular support, airway/ventilation management, control of seizure activity, and hydration in addition to the use of hydroxocobalamin.
Solution is bright red.

IBUTILIDE (CORVERT)

CLASS

Short-acting Class III antidysrhythmic

DESCRIPTION

Ibutilide prolongs the action potential duration and increases the refractory period of cardiac tissue. Ibutilide is recommended to convert acute supraventricular dysrhythmias, including atrial flutter and atrial fibrillation, when their duration is 48 hours or less. The drug may also be used as an adjunct to electrical cardioversion.

ONSET AND DURATION

Onset: ½ to 1½ hr
Duration: 10-12 hr

INDICATIONS

Supraventricular dysrhythmias
Conversion of atrial fibrillation and atrial flutter of brief duration

CONTRAINDICATIONS

History of heart failure or ventricular tachycardia
Patients with QTc >400 ms
Sensitivity to ibutilide

ADVERSE REACTIONS

Ventricular dysrhythmias, including polymorphic VT, torsades
Bradycardia
Hypotension and hypertension
Headache

DRUG INTERACTIONS

Avoid concurrent administration of ibutilide with other antidysrhythmics that prolong the refractory period

(e.g., amiodarone) or drugs that induce Q-T interval prolongation (e.g., procainamide).

HOW SUPPLIED

1 mg in 10-mL ampules

DOSAGE AND ADMINISTRATION

Adult (60 kg or more): 1 mg (10 mL) diluted or undiluted IV over 10 min. A second dose may be administered at the same rate 10 min later. The initial dose for adults who weigh less than 60 kg is 0.01 mg/kg IV.
Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Ibutilide must be given slowly IV over 10 min. This may make it impractical for use in emergent situations.
Ventricular dysrhythmias develop in 2% to 5% of patients who are given ibutilide; continuous electrocardiogram monitoring is essential.
Use with caution in patients with impaired left ventricular function.

INSULIN (REGULAR, NPH, AND OTHERS)

CLASS

Antidiabetic agent

DESCRIPTION

Insulin is secreted by the beta cells (islets of Langerhans) of the pancreas and is required for proper glucose utilization by the body. If insulin secretion is diminished (as in diabetes mellitus), supplemental insulin must be obtained by injection. Insulin preparations are classified as *short-acting* (regular) and *intermediate-acting* (NPH). Insulin seldom is administered in the prehospital setting, even when ketoacidosis is present. (Large amounts of normal saline solution are considered the first-line treatment.) Insulin may be required for long transport times.

ONSET AND DURATION

Onset: ½ to 1 hr (short-acting); 1 to 1½ hr (intermediate-acting); 4-6 hr (long-acting)
Duration: 6-8 hr (short-acting); 18-24 hr (intermediate-acting)

INDICATIONS

Type 1 diabetes mellitus
Type 2 diabetes mellitus if oral hypoglycemic agents do not control blood glucose adequately
Diabetic ketoacidosis
Nonketotic hyperosmolar coma
Insulin and 50% dextrose solution are given together to lower potassium levels in hyperkalemia.

CONTRAINDICATIONS

Hypoglycemia

ADVERSE REACTIONS

Hypoglycemia
Fatigue
Weakness
Confusion
Headache
Tachycardia
Rapid, shallow breathing
Nausea
Diaphoresis
Allergic reaction

DRUG INTERACTIONS

Corticosteroids, dobutamine, epinephrine, and thiazide diuretics may antagonize (decrease) the hypoglycemic effects of insulin.
Alcohol, beta-adrenergic blockers, MAO inhibitors, and salicylates may potentiate (increase) the hypoglycemic effects of insulin.

HOW SUPPLIED

100 units/mL in 10-mL vials

DOSAGE AND ADMINISTRATION

Insulin may be administered subQ or IM. Regular insulin can be given IV, and dosage is governed by the clinical presentation of the patient. A standard dose of insulin administration is as follows:
Adult: 10-25 units of regular insulin IV, followed by an infusion of 0.1 unit/kg/hr
Pediatric: 0.1-0.2 unit/kg/hr IM
Infusion: 100 units of regular insulin mixed in 100 mL of NS (1 unit/mL), infused at a rate of 0.1-0.2 unit/kg/hr (use infusion pump)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
Insulin is the drug of choice for control of diabetes in pregnancy.
Insulin injected into the abdominal wall is absorbed most rapidly, insulin in the arm is absorbed more slowly, and insulin is absorbed slowest when injected into the thigh.

IPRATROPIUM (ATROVENT)

CLASS

Anticholinergic, bronchodilator

DESCRIPTION

Ipratropium inhibits interaction of acetylcholine at receptor sites on bronchial smooth muscle, resulting in decreased levels of cyclic guanosine monophosphate and bronchodilation.

ONSET AND DURATION

Onset: 5-15 min
Duration: 4-6 hr

INDICATIONS

Persistent bronchospasm
Chronic obstructive pulmonary disease exacerbation

CONTRAINDICATIONS

Hypersensitivity to ipratropium, atropine, alkaloid, soybean protein, peanuts

ADVERSE REACTIONS

Nausea and vomiting
Cramps
Coughing
Worsening of symptoms
Headache
Tachycardia
Dry mouth
Blurred vision
Anxiety

DRUG INTERACTIONS

None reported

HOW SUPPLIED

Aerosol 17-18—nebulizer
18 mcg—MDI

DOSAGE AND ADMINISTRATION

NOTE: When used in combination with beta agonists (e.g., albuterol), the beta agonist is always administered first with a 5-min wait before administering ipratropium.
Adult: 1-2 inhalations
Pediatric: 250-500 mcg (by nebulizer or MDI) every 20 min times 3 doses

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
Shake well before use.
Use with caution in patients with urinary retention.

ISOPROTERENOL (ISUPREL)

CLASS

Sympathomimetic

DESCRIPTION

Isoproterenol is a synthetic catecholamine that stimulates both $beta_1$- and $beta_2$-adrenergic receptors (no alpha-receptor stimulation). The drug affects the heart by increasing inotropic and chronotropic activity. In addition, isoproterenol causes arterial and bronchial dilation and sometimes is administered via aerosolization as a bronchodilator to treat bronchial asthma and bronchospasm. (Because of the undesirable $beta_1$ cardiac effects, the use of this drug as a bronchodilator is uncommon in the prehospital setting.) Isoproterenol should be used cautiously as a temporizing measure if an external pacer is not available for symptomatic bradycardia.

ONSET AND DURATION

Onset: 1-5 min
Duration: 15-30 min

INDICATIONS

Hemodynamically significant bradycardias secondary to beta-blocker overdose
Management of refractory torsades de pointes, unresponsive to magnesium sulfate
Temporary control of bradycardia in heart transplant patients, unresponsive to atropine

CONTRAINDICATIONS

Ventricular tachycardia
Ventricular fibrillation
Hypotension (relative)
Pulseless idioventricular rhythm
Ischemic heart disease/angina (relative)
Cardiac arrest
Acetylcholinesterase-induced bradycardias
Poison/drug-induced shock (other than beta-blocker poisoning)

ADVERSE REACTIONS

Dysrhythmias
Hypotension
Precipitation of angina pectoris
Facial flushing
Restlessness
Dry throat
Discoloration of saliva (pinkish red)

DRUG INTERACTIONS

MAO inhibitors potentiate the effects of catecholamines.
Beta-adrenergic antagonists may blunt inotropic response.
Sympathomimetics and phosphodiesterase inhibitors may exacerbate dysrhythmia response.
Do not give with epinephrine; can cause VF or VT.

HOW SUPPLIED

5-mL (0.2 mg/mL) vial; 0.02 mg/mL in 1- and 10-mL vials

DOSAGE AND ADMINISTRATION

Adult: Dilute 1 mg in 250 mL of D_5W (4 mcg/mL); infuse at 2-10 mcg/min or until the desired heart rate is obtained; in torsades de pointes, titrate to increase heart rate until ventricular tachycardia is suppressed
Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Isoproterenol increases myocardial oxygen demand and can induce serious dysrhythmias (including ventricular tachycardia and ventricular fibrillation).
Administer via infusion pump to ensure precise flow rates.
Isoproterenol may exacerbate tachydysrhythmias caused by digitalis toxicity or hypokalemia.
Newer inotropic agents have replaced isoproterenol in most clinical settings.
If electronic pacing is available, it should be used instead of isoproterenol or as soon as possible after drug administration has been initiated.

KETAMINE (KETALAR)

CLASS

Nonbarbiturate anesthetic

DESCRIPTION

Ketamine acts on the limbic system and cortex to block afferent transmission of impulses associated with pain perception. It produces short-acting amnesia without muscular relaxation. Ketamine is a derivative of a drug of abuse, phencyclidine.

ONSET AND DURATION

Onset: Within 30 sec
Duration: 5-10 min

INDICATIONS

Pain control
As an adjunct to nitrous oxide

CONTRAINDICATIONS

Stroke
Increased intracranial pressure
Severe hypertension
Cardiac decompensation
Hypersensitivity to ketamine

ADVERSE REACTIONS

Hypertension
Increased heart rate
Hallucinations, delusions, explicit dreams
Less common side effects include hypotension, bradycardia, and respiratory depression

DRUG INTERACTIONS

No significant drug interactions have been reported.

HOW SUPPLIED

10, 50, and 100 mg/mL vials

DOSAGE AND ADMINISTRATION

Adult: 1-2 mg/kg IV over 1 min or 4-5 mg/kg IM
Child (>2 years of age): 1-2 mg/kg IV over 1 min or 3-5 mg/kg IM
Rapid Sequence Intubation
1-2 mg/kg IV/IO

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Ketamine may increase blood pressure, muscle tone, and heart rate.
As with any anesthetic, the dosage needs to be assessed carefully and individualized.
Keep patient in a quiet environment (if possible).

KETOROLAC TROMETHAMINE (TORADOL)

CLASS

Nonsteroidal antiinflammatory

DESCRIPTION

Ketorolac tromethamine is an antiinflammatory drug that also exhibits peripherally acting nonnarcotic analgesic activity by inhibiting prostaglandin synthesis.

ONSET AND DURATION

Onset: Within 10 min
Duration: 6-8 hr

INDICATIONS

Short-term management (less than 5 days) of moderate to severe pain

CONTRAINDICATIONS

Hypersensitivity to the drug
Patients with allergies to aspirin or other nonsteroidal antiinflammatory drugs
Bleeding disorders
Renal failure
Active peptic ulcer disease

ADVERSE REACTIONS

Anaphylaxis from hypersensitivity
Edema
Sedation
Bleeding disorders
Rash
Nausea
Headache

DRUG INTERACTIONS

Ketorolac may increase bleeding time when administered to patients taking anticoagulants.
Effects of lithium and methotrexate may be increased.

HOW SUPPLIED

15 or 30 mg in 1 mL
60 mg in 2 mL

DOSAGE AND ADMINISTRATION

Adult:
- IM: 1 dose of 60 mg (for patients <65 years of age); 1 dose of 30 mg for patients >65 years of age, have renal impairment, and/or weigh less than 50 kg
- IV: 30 mg over 1 min (for patients <65 years of age or weigh less than 50 kg); one-half dose (15 mg) for patients >65 years of age, have renal impairment, and/or weigh less than 50 kg

Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Solution is clear and slightly yellow.
Use with caution and reduce dose when administering to elderly patients.

LABETALOL (TRANDATE)

CLASS

Alpha- and beta-adrenergic blocker

DESCRIPTION

Labetalol is a competitive alpha$_1$-receptor blocker and a nonselective beta-receptor blocker that is used for lowering blood pressure in hypertensive crisis. Labetalol is a more potent beta blocker than alpha blocker. Blood pressure is reduced without reflex tachycardia, and total peripheral resistance is decreased, helping maintain cardiac output. In emergency care, labetalol is administered IV.

ONSET AND DURATION

Onset: Within 5 min
Duration: 3-6 hr

INDICATIONS

Hypertensive emergencies
All patients with suspected MI and unstable angina in the absence of contraindications (can reduce the incidence of VF)
Useful as an adjunctive agent with fibrinolytic therapy (may reduce nonfatal reinfarction and recurrent ischemia)
To convert to normal sinus rhythm or to slow ventricular response (or both) in supraventricular tachydysrhythmias (reentry SVT, atrial fibrillation, or atrial flutter)
To reduce myocardial ischemia in AMI patients with elevated heart rate, blood pressure, or both

CONTRAINDICATIONS

Hemodynamically unstable patients
STEMI if signs of heart failure, low cardiac output, or increased risk for cardiogenic shock are present
Relative contraindications include P-R interval >0.24 sec, second- or third-degree heart block, active asthma, reactive airway disease, severe bradycardia, SBP <100 mm Hg

ADVERSE REACTIONS

Headache
Dizziness
Edema
Fatigue
Vertigo
Ventricular dysrhythmias
Dyspnea
Allergic reaction
Facial flushing
Diaphoresis
Dose-related orthostatic hypotension (most common)
Bradycardia
Nausea and vomiting
Tinnitus

DRUG INTERACTIONS

Bronchodilator effects of beta-adrenergic agonists may be blunted by labetalol.
Nitroglycerin may augment hypotensive effects.

HOW SUPPLIED

5 mg/mL in 4-, 8-, 20-, and 40-mL vials

DOSAGE AND ADMINISTRATION

Adult: 10 mg IV over 1-2 min. May repeat or double labetalol every 10 min to a max dose of 150 mg. Alternative dosing: Give initial dose as a bolus, and then begin infusion at 2-8 mg/min
Infusion: Mix 200 mg in 250 mL of D_5W (0.8 mg/mL); infuse at a rate of 2-8 mg/min, titrated to supine blood pressure
Pediatric: Safety has not been established; initiate cautiously with careful dosage adjustments and blood pressure monitoring

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Blood pressure, pulse rate, and electrocardiogram should be monitored continuously.
Observe for signs of congestive heart failure, bradycardia, and bronchospasm.
Labetalol should be administered only with the patient in a supine position.

LEVALBUTEROL (XOPENEX)

CLASS

Sympathomimetic, bronchodilator, beta$_2$ agonist

DESCRIPTION

Levalbuterol is a relatively selective beta$_2$-adrenergic receptor agonist. It acts as a functional antagonist to relax the smooth muscles of all airways, from the trachea to the terminal bronchioles.

ONSET AND DURATION

Onset: 5-15 min after inhalation
Duration: 3-4 hr after inhalation

INDICATIONS

Treatment or prevention of bronchospasm in patients over 6 years of age with reversible, obstructive airway disease

CONTRAINDICATIONS

Prior hypersensitivity to levalbuterol or racemic albuterol
Cardiac dysrhythmias associated with tachycardia

ADVERSE REACTIONS

Usually dose related
Restlessness, apprehension, tremor
Chills, body pain, chest pain
Eye itch
Hypertension, hypotension, syncope
Palpitation, tachycardia
Dysrhythmias

DRUG INTERACTIONS

Other sympathomimetics may exacerbate adverse cardiovascular effects.
Antidepressants may potentiate effects on the vasculature (vasodilation).
Beta blockers may antagonize levalbuterol.
Levalbuterol may potentiate diuretic-induced hypokalemia.

HOW SUPPLIED

Solution for aerosolization: 3-mL unit dose (0.31, 0.63, 1.25 mg)
Solution packaged in color-coded foil pouches

DOSAGE AND ADMINISTRATION

Bronchospasm
Pediatric: 6-11 years old: 0.31 mg by nebulization q 6-8 hr. Dose not to exceed 0.63 mg every 6-8 hr
Adult: 12 or older: 0.63-1.25 mg by nebulization q 6-8 hr
NOTE: In settings of acute asthma, 1.25 mg of levalbuterol should be administered every 20 min for a total of 3 doses.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Levalbuterol should not be given to children younger than 6 years of age.
Levalbuterol may precipitate angina pectoris and dysrhythmias.
Levalbuterol is sometimes preferred over albuterol for patients with preexisting tachycardia.
Levalbuterol should be used with caution (if at all) in patients taking beta blockers, diuretics, digoxin, monamine oxidase inhibitors, or tricyclic antidepressants.

LIDOCAINE (XYLOCAINE)

CLASS

Antidysrhythmic (Class IB), local anesthetic

DESCRIPTION

Lidocaine decreases phase 4 diastolic depolarization (which decreases automaticity) and has been shown to be effective in suppressing premature ventricular complexes. In addition, lidocaine is used as an alternative to amiodarone to treat cardiac arrest from VT or VF. Lidocaine also raises the ventricular fibrillation threshold.

ONSET AND DURATION

Onset: 30-90 sec
Duration: 10-20 min

INDICATIONS

Cardiac arrest from ventricular tachycardia or ventricular fibrillation
Stable monomorphic VT with preserved ventricular function
Stable polymorphic VT with normal baseline Q-T interval and preserved LV function after correction of ischemia and electrolyte balance
Stable polymorphic VT with baseline-prolonged Q-T interval if torsades is suspected
Wide-complex tachycardia of uncertain origin
Significant ventricular ectopy in the setting of myocardial ischemia/infarction

CONTRAINDICATIONS

Prophylactic use in AMI
Hypersensitivity
Stokes-Adams syndrome
Second- or third-degree heart block in the absence of an artificial pacemaker

ADVERSE REACTIONS

Light-headedness
Confusion
Blurred vision
Hypotension
Bradycardia
Cardiovascular collapse
Bradycardia
Altered level of consciousness, irritability, muscle twitching, seizures with high doses
Headache
Seizures

DRUG INTERACTIONS

Metabolic clearance of lidocaine may be decreased in patients taking beta-adrenergic blockers or in patients with decreased cardiac output or liver dysfunction.
Apnea induced with succinylcholine may be prolonged with large doses of lidocaine.
Cardiac depression may occur if lidocaine is given concomitantly with IV phenytoin.
Additive neurological effects may occur with procainamide and tocainide.

HOW SUPPLIED

Prefilled syringes: 100 mg in 5 mL of solution; 1- and 2-g additive syringes
Ampules: 100 mg in 5 mL of solution; 1- and 2-g vials in 30 mL of solution; 5 mL containing 100 mg/mL

DOSAGE AND ADMINISTRATION

Cardiac Arrest From Ventricular Tachycardia/Ventricular Fibrillation
Adult: 1-1.5 mg/kg IV/IO bolus or endotracheal tube (at 2-2.5 times the IV dose); for refractory VF, may give additional 0.5-0.75 mg/kg IV push; repeat in 5-10 min; max 3 doses or total of 3 mg/kg
Pediatric: 1 mg/kg IV/IO loading dose; ET dose: 2-3 mg/kg
Perfusing Dysrhythmia (Stable VT; Wide-Complex Tachycardia of Uncertain Type; Significant Ectopy)
Adult: Doses may range from 0.5 to 0.75 mg/kg (up to 1-1.5 mg/kg may be used). Repeat 0.5-0.75 mg/kg every 5-10 min; max total dose 3 mg/kg
Pediatric: 1 mg/kg IV/IO. ET dose is 2-3 mg/kg
Maintenance Infusion After Resuscitation From Cardiac Arrest From Ventricular Tachycardia/Ventricular Fibrillation
Adult: 1-4 mg/min (30-50 mcg/kg/min); reduce maintenance dose (not loading dose) in presence of impaired liver function or LV dysfunction
Pediatric: 20-50 mcg/kg/min IV/IO; repeat bolus dose if infusion initiated >15 min after initial bolus therapy
Pediatric: Initial loading dose of 1 mg/kg IV/IO, followed by infusion of 20-50 mcg/kg/min
Rapid Sequence Intubation
1-2 mg/kg IV/IO (max 100 mg)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
A 75-100 mg bolus will maintain adequate blood levels for only 20 min (in absence of shock).
If bradycardia occurs along with premature ventricular contractions, always treat the bradycardia first with atropine.
Discontinue infusion immediately if signs of toxicity develop.
Exceedingly high doses of lidocaine can result in coma or death.
Decrease dose in the elderly.
Avoid lidocaine for reperfusion dysrhythmias following fibrinolytic therapy.
Use extreme caution in patients with hepatic disease, heart failure, marked hypoxia, severe respiratory depression, hypovolemia or shock, incomplete heart block, or bradycardia and atrial fibrillation.

LORAZEPAM (ATIVAN)

CLASS

Benzodiazepine

DESCRIPTION

Lorazepam is a benzodiazepine with antianxiety and anticonvulsant effects. When given by injection, it appears to suppress the propagation of seizure activity produced by foci in the cortex, thalamus, and limbic areas.

ONSET AND DURATION

Onset: 5 min (IV)
Duration: 6-8 hr

INDICATIONS

Agitation requiring sedation
Initial control of status epilepticus or severe recurrent seizures (investigational)

CONTRAINDICATIONS

Hypersensitivity to the drug
Substance abuse (relative)
Coma (unless seizing)
Severe hypotension
Shock
Preexisting central nervous system depression

ADVERSE REACTIONS

Respiratory depression
Tachycardia/bradycardia
Hypotension
Sedation
Ataxia
Psychomotor impairment
Confusion
Blurred vision

DRUG INTERACTIONS

Lorazepam may precipitate central nervous system depression and psychomotor impairment when the patient is taking central nervous system depressant medications.

HOW SUPPLIED

2 and 4 mg/mL concentrations in 1-mL vials

DOSAGE AND ADMINISTRATION

Before IV administration, lorazepam must be diluted with an equal volume of sterile water or sterile saline. When given IM, lorazepam is not to be diluted.
Adult: 1-4 mg slow IM/IV over 2-10 min; may be repeated in 15-20 min to a max dose of 8 mg

Pediatric (not FDA-approved): 0.05-0.1 mg/kg slow IV/IO/IM over 2 min; may be repeated once in 5-10 min to a max dose of 4 mg; 0.1-0.2 mg/kg (rectal dose)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D
Monitor respiratory rate and blood pressure during administration.
Have suction and intubation equipment available.
Inadvertent intraarterial injection may produce arteriospasm, resulting in gangrene that may require amputation.
Lorazepam expires in 6 weeks when not refrigerated; do not use if discolored or if solution contains precipitate.

MAGNESIUM SULFATE

CLASS

Electrolyte, anticonvulsant

DESCRIPTION

Magnesium sulfate reduces striated muscle contractions and blocks peripheral neuromuscular transmission by reducing acetylcholine release at the myoneural junction. In emergency care, magnesium sulfate is used in the management of seizures associated with toxemia of pregnancy. Other uses of magnesium sulfate include uterine relaxation (to inhibit contractions of premature labor), as a bronchodilator after beta-agonist and anticholinergic agents have been used, and replacement therapy for magnesium deficiency. Magnesium sulfate is recommended for use in cardiac arrest only if torsades de pointes or suspected hypomagnesemia is present.

ONSET AND DURATION

Onset: (IV) Immediate; (IM) 3-4 hr
Duration: 30 min (IV); 3-4 hr (IM)

INDICATIONS

Seizures of eclampsia (toxemia of pregnancy)
Cardiac arrest only if torsades de pointes is suspected or hypomagnesemia is present
Life-threatening ventricular dysrhythmias attributable to digitalis toxicity
Suspected hypomagnesemia
Status asthmaticus not responsive to beta-adrenergic drugs

CONTRAINDICATIONS

Heart block or myocardial damage

ADVERSE REACTIONS

Diaphoresis
Facial flushing
Hypotension
Depressed reflexes
Hypothermia
Reduced heart rate
Circulatory collapse
Respiratory depression
Diarrhea
Nausea and vomiting

DRUG INTERACTIONS

Central nervous system depressant effects may be enhanced if the patient is taking other central nervous system depressants.
Serious changes in cardiac function may occur with cardiac glycosides (avoid excess magnesium administration).

HOW SUPPLIED

10%, 12.5%, 50% solution in 40, 80, 100, and 125 mg/mL

DOSAGE AND ADMINISTRATION

Seizure Activity Associated With Pregnancy
Adult: 1-4 g (8-32 mEq) IV; max dose of 30-40 g/day
Pulseless Arrest (for Hypomagnesemia or Torsades de Pointes), Status Asthmaticus
Adult: 1-2 g (2-4 mL of a 50% solution) diluted in 10 mL of D_5W IV/IO push
Pediatric: 25-50 mg/kg IV/IO (max 2 g) over 10-20 min; over 15-30 min for status asthmaticus
Torsades de Pointes With Pulse or AMI With Hypomagnesemia
Adult: Loading dose of 1-2 g in 50-100 mL of D_5W over 5-60 min IV; follow with 0.5-1 g/hr IV (titrate dose to control torsades)
Pediatric: Same as pulseless arrest

SPECIAL CONSIDERATIONS

Pregnancy safety: Category A
Magnesium sulfate is administered for the treatment of toxemia of pregnancy. It is recommended that the drug not be administered in the 2 hr before delivery, if possible. IV calcium gluconate or calcium chloride should be available as an antagonist to magnesium if needed
Convulsions may occur up to 48 hr after delivery, necessitating continued therapy.
The "cure" for toxemia is delivery of the baby.
Magnesium must be used with caution in patients with renal failure because it is cleared by the kidneys and can reach toxic levels easily in those patients.

MANNITOL (OSMITROL)

CLASS

Osmotic diuretic

DESCRIPTION

Because of the osmotic properties of mannitol, the drug promotes the movement of fluid from the intracellular into the extracellular space. In emergency care, mannitol most often is used to decrease cerebral edema and intracranial pressure caused by head injury or mass lesions.

ONSET AND DURATION

Onset: 1-3 hr for diuretic effect; within 15 min for reduction of intracranial pressure
Duration: 4-6 hr for diuretic effect; 3-8 hr for reduction of intracranial pressure

INDICATIONS

Cerebral edema
Other causes of increased intracranial pressure (space-occupying lesions)
Rhabdomyolysis (myoglobinuria)
Blood transfusion reactions
Promoting urinary excretion of toxic substances

CONTRAINDICATIONS

Severe hypotension
Active intracranial bleeding
Dehydration
Hyponatremia
Severe pulmonary edema or congestion
Profound hypovolemia
Severe renal disease (anuria)

ADVERSE REACTIONS

Transient volume overload
Pulmonary edema
Renal failure
Congestive heart failure
Hypotension (from excessive diuresis)
Sodium depletion
Nausea and vomiting

DRUG INTERACTIONS

When given concurrently with digitalis glycosides, an increase in digitalis toxicity may develop.

HOW SUPPLIED

250 and 500 mL of a 20% solution for IV infusion (200 mg/mL); 25% solution in 50 mL for slow IV push

DOSAGE AND ADMINISTRATION

Adult: 0.5-1 g/kg in a 20% solution over 5-10 min through an in-line filter; usual adult dose is 20-200 g/24 hr. Additional doses of 0.25-2 g/kg can be given every 4-6 hr as needed
Pediatric: 0.2-0.5 g/kg dose IV infusion over 30-60 min (max dose: 1 g/kg) every 4-6 hr

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Mannitol may crystallize at low temperatures and may need to be warmed in boiling water until clear (cool to body temperature before use).
In-line filter should always be used.
Use with support of oxygenation and ventilation.
Effectiveness depends on large doses and an intact blood-brain barrier.
The use of mannitol and its dosages in emergency care are controversial.

MEPERIDINE (DEMEROL)

CLASS

Opioid analgesic

DESCRIPTION

Meperidine is a synthetic opioid agonist that works at opioid receptors to produce analgesia and euphoria. Excessive doses can cause respiratory and central nervous system depression and seizures. It has high potential for physical dependence and abuse and is classified as a schedule II drug.

ONSET AND DURATION

Onset: (IM) 10-15 min; (IV) within 5 min
Duration: 2-4 hr

INDICATIONS

Moderate to severe pain
Preoperative medication
Obstetrical analgesia

CONTRAINDICATIONS

Hypersensitivity to narcotics
Patients taking MAO inhibitors or selective serotonin reuptake inhibitors
During labor or delivery of a premature infant
Head injury

ADVERSE REACTIONS

Respiratory depression
Nausea and vomiting
Euphoria
Delirium
Agitation
Hallucination
Seizures
Headache
Hypotension
Visual disturbances
Coma
Facial flushing
Circulatory collapse
Dysrhythmias
Allergic reaction
Drowsiness

DRUG INTERACTIONS

Respiratory depression, hypotension, or sedation may be potentiated by central nervous system depressants.
Therapeutic doses of meperidine have caused fatal reactions in patients taking MAO inhibitors within the previous 14 days.
Phenytoin may decrease analgesic effects.

HOW SUPPLIED

Parenteral: 25, 50, 100 mg/mL in 1- and 5-mL prefilled syringe and tubex

DOSAGE AND ADMINISTRATION

Adult: 50-100 mg IM every 3-4 hr as needed; 15-35 mg IV per hour (dose should be individualized)
Elderly: 25 mg IM every 4 hr as needed
Pediatric: 1-2 mg/kg dose IM every 3-4 hr as needed; maximum single dose not to exceed 100 mg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B (if not used for prolonged periods or in high doses at term)
Use with caution in patients with asthma and chronic obstructive pulmonary disease.
Meperidine may aggravate seizures in those with convulsive disorders (especially in patients with renal insufficiency).
Use with caution in those susceptible to central nervous system depression.
Naloxone should be readily available.
Protect from light and freezing.
Use with caution in patients with SVT

METHYLPREDNISOLONE (SOLU-MEDROL)

CLASS

Glucocorticoid

DESCRIPTION

Methylprednisolone is a synthetic steroid that suppresses acute and chronic inflammation. In addition, it potentiates vascular smooth muscle relaxation by beta-adrenergic agonists and may alter airway hyperactivity. It currently is used for reduction of posttraumatic spinal cord edema, but this indication is controversial.[2]

ONSET AND DURATION

Onset: 1-2 hr
Duration: 8-24 hr

INDICATIONS

Anaphylaxis
Bronchodilator: unresponsive asthma
Shock (controversial)
Acute spinal cord injury (controversial)
Adrenal insufficiency (hydrocortisone [Solu-Cortef] also may be used)

CONTRAINDICATIONS

Use with caution in patients with gastrointestinal bleeding, diabetes mellitus, or severe infection.

ADVERSE REACTIONS

Headache
Hypertension
Sodium and water retention
Hypokalemia
Alkalosis

DRUG INTERACTIONS

Hypoglycemic responses to insulin and oral hypoglycemic agents may be blunted.
Potassium-depleting agents may potentiate hypokalemia induced by corticosteroids.

HOW SUPPLIED

20, 40, 80 mg/mL; 125 mg/2 mL

DOSAGE AND ADMINISTRATION

Adult: Variable; usually within the range of 40-125 mg IV. (Higher doses for spinal cord injury, per medical direction.)
Pediatric: Loading dose: 1-2 mg/kg IV

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

METOCLOPRAMIDE (METOZOLV ODT, OCTAMIDE, REGLAN)

CLASS

Antiemetic, GI stimulant

DESCRIPTION

Metoclopramide enhances GI motility. The drug is chemically related to procainamide, but has no anesthetic or antidysrhythmic properties. Metoclopramide was originally developed to treat nausea during pregnancy but is also useful in the treatment of chemotherapy-induced nausea and vomiting.

ONSET AND DURATION

Onset: 30-60 min (oral); 1-3 min (IV); 10-15 min (IM)
Duration: 1-2 hr

INDICATIONS

Nausea
Vomiting

CONTRAINDICATIONS

Hypersensitivity to the drug or procainamide
GI obstruction, bleeding, or perforation

ADVERSE REACTIONS

CNS effects may occur
Confusion
Depression
Drowsiness
Cardiac conduction disturbances

Fatigue
Headache
Hypotension
Hypertension
Nausea
Insomnia
Tardive dyskinesia

DRUG INTERACTIONS

Metoclopramide can increase the rate or extent of absorption of other drugs (acetaminophen, aspirin) because of accelerated gastric emptying.
Digoxin absorption and bioavailability may be diminished in some patients.

HOW SUPPLIED

Tablet: 5, 10 mg
Oral solution: 5 mg/mL
Solution for injection: 5 mg/mL

DOSAGE AND ADMINISTRATION

Pregnant women: 5 mg PO every 8 hr as needed
Chemotherapy-induced nausea and vomiting:
IM: 10 mg; may be repeated in 4-6 hr as needed
IV: 1-2 mg/kg; may be repeated twice at 2-hr intervals
Children: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
Use with caution in patients with renal disease, such as renal failure or renal impairment, attributable to possible accumulation and toxicity.
Not recommended for patients with Parkinson's disease.
Concurrent use of ethanol can increase the CNS depressant effects of metoclopramide. Combined use of metoclopramide and other CNS depressants, such as anxiolytics, sedatives, and hypnotics, can increase possible sedation.

METOPROLOL (LOPRESSOR)

CLASS

Beta-blocking agent

DESCRIPTION

Beta-adrenergic blocking agents compete with beta-adrenergic agonists for available beta-receptor sites on the membrane of cardiac muscle, bronchial smooth muscle, and the smooth muscle of blood vessels. The $beta_1$-blocking action on the heart decreases heart rate, conduction velocity, myocardial contractility, and cardiac output. Metoprolol is used to control ventricular response in supraventricular tachydysrhythmias (paroxysmal supraventricular tachycardia, atrial fibrillation, atrial flutter). Metoprolol is considered a second-line agent after adenosine, diltiazem, or a digitalis derivative.

ONSET AND DURATION

Onset: 1-2 min
Duration: 3-4 hr

INDICATIONS

All patients with suspected MI and unstable angina in the absence of contraindications (can reduce the incidence of VF)
Useful as an adjunctive agent with fibrinolytic therapy (may reduce nonfatal reinfarction and recurrent ischemia)
To convert to normal sinus rhythm or to slow ventricular response (or both) in supraventricular tachydysrhythmias (reentry SVT, atrial fibrillation, or atrial flutter)
To reduce myocardial ischemia in AMI patients with elevated heart rate, blood pressure, or both

CONTRAINDICATIONS

Hemodynamically unstable patients
STEMI if signs of heart failure, low cardiac output, or increased risk for cardiogenic shock are present
Relative contraindications include P-R interval >0.24 sec, second- or third-degree heart block, active asthma, reactive airway disease, severe bradycardia, SBP <100 mm Hg

ADVERSE REACTIONS

Bradycardia
Atrioventricular conduction delays
Hypotension
Palpitations
Nausea and vomiting

DRUG INTERACTIONS

Metoprolol may potentiate antihypertensive effects when given to patients taking calcium channel blockers or MAO inhibitors.
Catecholamine-depleting drugs may potentiate hypotension.
Sympathomimetic effects may be antagonized; signs of hypoglycemia may be masked.

HOW SUPPLIED

1 mg/mL, 5 mg/5 mL ampules

DOSAGE AND ADMINISTRATION

Adult: 5 mg slow IV at 5-min intervals to a total of 15 mg
Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Metoprolol must be given slowly IV over 5 min.
Concurrent IV administration with IV calcium channel blockers such as verapamil or diltiazem can cause severe hypotension.
Metoprolol should be used with caution in persons with liver or renal dysfunction.

MIDAZOLAM HYDROCHLORIDE (VERSED)

CLASS

Short-acting benzodiazepine

DESCRIPTION

Midazolam hydrochloride is a water-soluble benzodiazepine that may be administered for conscious sedation to relieve apprehension or impair memory before tracheal intubation or cardioversion. The drug may also be used in the management of seizures in children.

ONSET AND DURATION

Onset: 1-3 min (IV); dose dependent
Duration: 2-6 hr; dose dependent

INDICATIONS

Premedication for tracheal intubation, cardioversion, or other painful procedures
Seizures in children when other benzodiazepines are not effective

CONTRAINDICATIONS

Hypersensitivity to midazolam
Glaucoma (relative)
Shock
Coma
Alcohol intoxication (relative; may be used for alcohol withdrawal)
Depressed vital signs
Concomitant use of barbiturates, alcohol, narcotics, or other central nervous system depressants

ADVERSE REACTIONS

Respiratory depression
Hiccups
Cough
Oversedation
Pain at the injection site
Nausea and vomiting
Headache
Blurred vision
Fluctuations in vital signs
Hypotension
Respiratory arrest

DRUG INTERACTIONS

Sedative effect of midazolam may be accentuated by concomitant use of barbiturates, alcohol, or narcotics (and therefore should not be used in patients who have taken central nervous system depressants).

HOW SUPPLIED

2-, 5-, 10-mL vials (1 mg/mL)
1-, 2-, 5-, 10-mL vials (5 mg/mL)

DOSAGE AND ADMINISTRATION

Sedation
Adult: 1-2.5 mg slow IV (over 2-3 min); may be repeated if necessary in small increments (total max dose not to exceed 0.1 mg/kg)
Elderly: 0.5 mg slow IV (max: 1.5 mg in a 2-min period)
Pediatric: Loading dose: 0.05-0.2 mg/kg; then continue infusion 1-2 mcg/kg/min
Seizures in children: 0.1-0.15 mg/kg (max dose 5 mg) IV slow over 1-2 min or IM
Rapid Sequence Intubation
0.1-0.3 mg/kg IV/IO; max single dose: 10 mg

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D
Never administer medication as IV bolus.
NOTE: Midazolam has been associated with respiratory depression and respiratory arrest when used for sedation. Its use requires continuous monitoring of respiratory and cardiac function. Emergency airway equipment should be readily available.

MORPHINE SULFATE (ASTRAMORPH/PF AND OTHERS)

CLASS

Opioid analgesic

DESCRIPTION

Morphine sulfate is a natural opium alkaloid that has a primary effect of analgesia. It also increases peripheral venous capacitance and decreases venous return (chemical phlebotomy). Morphine sulfate causes euphoria and respiratory and central nervous system depression. Secondary pharmacological effects of morphine include depressed responsiveness of alpha-adrenergic receptors (producing peripheral vasodilation) and baroreceptor inhibition. In addition, because morphine decreases preload and afterload, it may decrease myocardial oxygen demand. The properties of this medication make it extremely useful in emergency care. Morphine sulfate is a schedule II drug.

ONSET AND DURATION

Onset: 1-2 min after administration
Duration: 2-7 hr

INDICATIONS

Chest pain associated with ACS unresponsive to nitrates
Acute cardiogenic pulmonary edema (with adequate blood pressure), with or without associated pain
Moderate to severe acute and chronic pain

CONTRAINDICATIONS

Hypersensitivity to narcotics
Hypovolemia
Hypotension
Head injury or undiagnosed abdominal pain

Increased intracranial pressure
Severe respiratory depression
Patients who have taken MAO inhibitors within 14 days
Use with caution in RV infarction

ADVERSE REACTIONS

Hypotension in volume-depleted patients
Tachycardia
Bradycardia
Palpitations
Syncope
Facial flushing, diaphoresis, pruritus
Respiratory depression
Euphoria
Bronchospasm
Dry mouth
Allergic reaction

DRUG INTERACTIONS

Central nervous system depressants may potentiate effects of morphine (respiratory depression, hypotension, sedation).
Phenothiazines may potentiate analgesia.
MAO inhibitors may cause paradoxical excitation.

HOW SUPPLIED

Morphine is supplied in tablets, suppositories, and solution. In emergency care, morphine sulfate usually is administered IV.
Parenteral preparations are available in many strengths. A common preparation is 10 mg in 1 mL of solution, ampules and Tubex syringes.

DOSAGE AND ADMINISTRATION

Adult:
- STEMI: 2-4 mg IV; may give additional doses of 2-8 mg IV at 5- to 15-min intervals
- UA/NSTEMI: 1-5 mg IV only if symptoms not relieved by nitrates or if symptoms recur (use with caution)
- Pain: 2-4 mg slow IV over 1-5 min every 5-30 min; titrated to effect

Pediatric: 0.1-0.2 mg/kg dose IV (max total dose: 15 mg)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B (if not used for prolonged periods or in high doses at term); narcotics rapidly cross the placenta
Safety in neonates has not been established.
Use with caution in the elderly, in those with asthma, and in those susceptible to central nervous system depression.
Morphine should be used with caution in chronic pain syndromes.
Morphine may worsen bradycardia or heart block in inferior myocardial infarction (vagotonic effect).
Naloxone (0.4-2 mg IV) should be readily available.

NALOXONE (NARCAN)

CLASS

Opioid antagonist

DESCRIPTION

Naloxone is a competitive narcotic antagonist used in the management of known or suspected overdose caused by narcotics. Naloxone antagonizes all actions of morphine. Naloxone is the preferred first-line agent in suspected opioid overdose unresponsive to oxygen and support of ventilation.

ONSET AND DURATION

Onset: Within 2 min
Duration: 30-60 min

INDICATIONS

For the complete or partial reversal of central nervous system and respiratory depression induced by opioids including the following:
Narcotic Agonist
- Morphine sulfate
- Heroin
- Hydromorphone
- Methadone
- Meperidine
- Paregoric
- Fentanyl citrate
- Oxycodone
- Codeine

Narcotic Agonist/Antagonist
- Butorphanol tartrate
- Pentazocine
- Nalbuphine

Decreased Level of Consciousness
Coma of Unknown Origin

CONTRAINDICATIONS

Hypersensitivity
Use with caution in narcotic-dependent patients who may experience withdrawal syndrome (including neonates of narcotic-dependent mothers).
Avoid use in meperidine-induced seizures

ADVERSE REACTIONS

Tachycardia
Hypertension
Dysrhythmias
Nausea and vomiting
Diaphoresis
Blurred vision
Withdrawal (opiate)

DRUG INTERACTIONS

Incompatible with bisulfite and alkaline solutions

HOW SUPPLIED

0.4 mg/mL (1, 10 mL); 1 mg/mL (2-mL) vials

DOSAGE AND ADMINISTRATION

Adult:

- Typical IV (or endotracheal tube diluted) dose: 0.4-mg; titrate until ventilation is adequate. Use higher doses (up to 2 mg) for complete narcotic reversal. Can administer up to 6-10 mg over short period (<10 min). For respiratory depression from sedation, smaller doses of 0.4 mg repeated every 2-3 min may be used. For chronic opioid-addicted patients use smaller doses and titrate slowly.
- IM/subQ dose: 0.4-0.8 mg

Pediatric:

- 0.1 mg/kg IV/IO/ET (diluted) every 2 min as needed for total reversal of narcotic effects (max 2 mg); if total reversal is not required, smaller doses (0.001-0.005 mg/kg) may be used, titrated to effect.
- Pediatric IV/IO infusion: 0.002-0.16 mg/kg (2-160 mcg/kg) per hour

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

Some research has demonstrated the efficacy of intranasal naloxone administration; however, the optimal dose for the intranasal route has not been established.

Seizures have been reported (no causal relationship has been established).

Naloxone may not reverse hypotension.

Exercise caution and use smaller doses when administering naloxone to narcotic addicts (may precipitate withdrawal with hypertension, tachycardia, and violent behavior).

Rare anaphylactic reactions have been reported.

NITROGLYCERIN (NITROSTAT AND OTHERS)

CLASS

Vasodilator

DESCRIPTION

Nitrates and nitrites dilate arterioles and veins in the periphery (and coronary arteries in high doses). The resultant reduction in preload, and to a lesser extent in afterload, decreases the workload of the heart and lowers myocardial oxygen demand. Nitroglycerin is lipid soluble and is thought to enter the body from the gastrointestinal tract through the lymphatics rather than the portal blood.

ONSET AND DURATION

Onset: 1-3 min

Duration: 30-60 min

INDICATIONS

Ischemic chest pain

Congestive heart failure

AMI (large anterior wall infarction, persistent or recurrent ischemia, hypertension)

Hypertensive emergencies with ACS

CONTRAINDICATIONS

Volume depletion

Hypersensitivity

Hypotension (SBP <90 mm Hg or ≥30 mm Hg below baseline)

Head injury

Extreme bradycardia (HR <50 beats/min)

Extreme tachycardia (HR >100 beats/min) in the absence of heart failure

Right ventricular infarction

Cerebral hemorrhage

Recent use of tadalafil (Cialis), vardenafil (Levitra), or sildenafil (Viagra)

Aortic stenosis

ADVERSE REACTIONS

Transient headache

Reflex tachycardia

Hypotension

Nausea and vomiting

Postural syncope

Diaphoresis

Flushing

DRUG INTERACTIONS

Other vasodilators may have additive hypotensive effects.

Do not mix with other drugs.

HOW SUPPLIED

Tablets: 0.15 mg (1/400 gr), 0.3 mg (1/200 gr), 0.4 mg (1/150 gr), 0.6 (1/100 gr), and extended-release capsules and transdermal preparations

Metered spray: 0.4 mg per spray (do not shake)

Parenteral: 5 mg/mL; 10, 20, 40 mg/100 mL

DOSAGE AND ADMINISTRATION

Adult:

- Tablet: 0.3-0.4 mg sublingually; may repeat for a total of 3 doses at 5-min intervals
- Metered spray: 1-2 sprays (0.4 mg/dose) for 0.5-1 sec at 5-min intervals; max 3 sprays within 15 min

Infusion: Begin at a rate of 10 mcg/min; increase by 10 mcg/min q 3-5 min until desired effect is achieved; ceiling dose of 200 mcg/min commonly used
Pediatric (continuous infusion): Initial dose 0.25-0.5 mcg/kg/min; titrate by 1 mcg/kg/min every 15-20 min; typical dose range: 1-5 mcg/kg/min

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Nitroglycerin is associated with increased susceptibility to hypotension in the elderly.
Nitroglycerin decomposes when exposed to light or heat.
Nitroglycerin must be kept in airtight containers.
Active ingredient of nitroglycerin will "sting" when administered sublingually.
Use with extreme caution in patients with inferior acute myocardial infarction with possible right ventricular involvement.
Administer IV nitroglycerin by infusion pump to ensure precise flow rate.
PVC tubing may absorb up to 80% of available drug; non-PVC tubing should be used.

NITROPASTE (NITRO-BID OINTMENT)

CLASS

Vasodilator

DESCRIPTION

Nitropaste contains a 2% solution of nitroglycerin in an absorbent paste.

ONSET AND DURATION

Onset: 15-60 min
Duration: 2-12 hr

INDICATIONS

Angina pectoris
Chest pain associated with acute myocardial infarction (less easily titratable than IV nitroglycerin)

CONTRAINDICATIONS

Same as those for nitroglycerin
Hypersensitivity
Hypotension
Head injury
Cerebral hemorrhage

ADVERSE REACTIONS

Transient headache
Postural syncope
Reflex tachycardia
Hypotension
Nausea and vomiting
Allergic reaction

DRUG INTERACTIONS

Other vasodilators may have additive hypotensive effects.

HOW SUPPLIED

20-, 60-g tubes of 2% nitroglycerin paste (measuring applicators are supplied)

DOSAGE AND ADMINISTRATION

Adult: Apply 1-2 inches over 2- to 4-inch area of skin that is free of hair (usually the chest wall); cover with transparent wrap and secure with tape
Pediatric: Not recommended

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Wear gloves when applying paste.
Do not massage or rub paste (rapid absorption will interfere with the sustained action of the drug).
Store paste in a cool place with the tube tightly capped.
Although the adverse effects for nitropaste are the same as those for sublingually administered nitroglycerin, their frequency and severity usually are considerably less with the sustained-release preparations because of the slower absorption and less erratic serum levels.

NITROPRUSSIDE

CLASS

Vasodilator

DESCRIPTION

Nitroprusside is an intravenous hypotensive agent effective in the acute management of hypertensive crisis and in the management of congestive heart failure. Nitroprusside-induced peripheral vasodilation results in a reduced left ventricular afterload. This, along with a reduced venous return to the heart, causes a slight increase in heart rate and decrease in cardiac output in hypertensive patients. In patients with congestive heart failure, nitroprusside improves left ventricular heart performance, increasing cardiac output and stroke volume. The peripheral vasodilatory effects of nitroprusside are due to a direct action of the drug on arterial and venous smooth muscle.

ONSET AND DURATION

Onset: Immediate
Duration: 1-10 min following infusion

INDICATIONS

Heart failure
Hypertensive emergency
Hypotension induction

CONTRAINDICATIONS

Aortic coarctation
AV shunt
High-output cardiac failure

Hypotension
Hypovolemia
Increased ICP
Pulmonary or renal disease
Cyanide toxicity
Recent ingestion of drugs for erectile dysfunction (e.g., sildenafil)

ADVERSE REACTIONS

Abdominal pain
Ataxia
Bradycardia
Coma
Confusion
Cyanide toxicity
Diaphoresis
Dizziness
Dyspnea
Flushing
Headache
Hyperreflexia
Hypotension
Increased ICP
Muscle cramps
Seizures
Syncope
Tachycardia
Vomiting

DRUG INTERACTIONS

Additive hypotensive effects may occur when nitroprusside is used concomitantly with other antihypertensive agents, general anesthetics, ganglionic blocking agents, and negative inotropic agents.
Sympathomimetics, such as cocaine, dobutamine, dopamine, norepinephrine, epinephrine, and others, may antagonize the antihypertensive effects of nitroprusside when administered concomitantly.
Additive hypotensive effects may be seen when MAOIs are combined with antihypertensives or medications with hypotensive properties.

HOW SUPPLIED

50 mg/2 mL for injection: Must be diluted with dextrose 5% in water (D_5W) before administration. Do not administer by direct injection. Administer diluted solution by IV infusion using a controlled infusion device.

DOSAGE AND ADMINISTRATION

Adults and children: Begin at 0.1 mcg/kg/min and titrate upward every 3-5 min to desired effect (usually up to 5 mcg/kg/min, but higher doses up to 10 mcg/kg/min may be needed). Infusion is titrated to desired blood pressure and/or cardiac output.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Nitroprusside should be used only when appropriate monitoring equipment and personnel are available; blood pressure should be continuously monitored.
Use of infusion pump is strongly advised.
Cyanide toxicity or methemoglobinemia may occur with prolonged administration.
Use lower end dosage range for elderly patients.
Protect nitroprusside from light.

NITROUS OXIDE/OXYGEN (50:50) (NITRONOX)

CLASS

Gaseous analgesic/anesthetic

DESCRIPTION

Nitrous oxide/oxygen is a blended mixture of 50% nitrous oxide and 50% oxygen. When inhaled, nitrous oxide/oxygen depresses the central nervous system, causing anesthesia. In addition, the high concentration of oxygen delivered along with the nitrous oxide increases oxygen tension in the blood, thereby reducing hypoxia. Nitrous oxide/oxygen is self-administered.

ONSET AND DURATION

Onset: 2-5 min
Duration: 2-5 min

INDICATIONS

Moderate to severe pain
Anxiety
Apprehension

CONTRAINDICATIONS

Impaired level of consciousness
Head injury
Chest trauma (pneumothorax)
Inability to comply with instructions
Decompression sickness (nitrogen narcosis, air embolus, air transport)
Undiagnosed abdominal pain or marked distention
Bowel obstruction
Hypotension
Shock
Chronic obstructive pulmonary disease (with history or suspicion of CO_2 retention)

ADVERSE REACTIONS

Dizziness
Apnea
Cyanosis

Nausea and vomiting
Malignant hyperthermia (rare but dangerous)

DRUG INTERACTIONS

None significant

HOW SUPPLIED

D and E cylinders (blue and white in Canada, blue and green in United States) of 50% nitrous oxide and 50% oxygen compressed gas

DOSAGE AND ADMINISTRATION

Adult: Invert cylinder several times before use; instruct the patient to inhale deeply through a patient-held mask or mouthpiece
Pediatric: Same as adult

SPECIAL CONSIDERATIONS

Pregnancy safety: Nitrous oxide has been shown to increase the incidence of spontaneous abortion.
Nitrous oxide is 34 times more soluble than nitrogen and will diffuse into pockets of trapped gas in the patient (intestinal obstruction, pneumothorax, blocked middle ear).
As the nitrogen leaves and is replaced by larger amounts of nitrous oxide, increased pressures or volumes may cause serious damage, for example, intestinal rupture.
Nitrous oxide is a nonexplosive gas.
Patient must hold mask and self-administer.

NOTE

When delivering nitrous oxide and oxygen from a single tank, the paramedic must ensure that enough oxygen remains in the tank to provide adequate oxygenation. Inverting the cylinder several times to mix the gases is important for this reason. Monitoring of oximetry during administration of nitrous oxide also is reasonable.

NOREPINEPHRINE (LEVOPHED)

CLASS

Sympathomimetic

DESCRIPTION

Norepinephrine is an alpha- and beta$_1$-adrenergic agonist. Norepinephrine is a potent vasoconstrictor that also increases myocardial contractility. Because norepinephrine tends to constrict the renal and mesenteric blood vessels, it rarely is used in the prehospital setting. It is an agent of last resort for management of ischemic heart disease and shock.

ONSET AND DURATION

Onset: 1-3 min
Duration: 5-10 min

INDICATIONS

Severe cardiogenic shock
Neurogenic shock
Inotropic support
Hemodynamically significant hypotension (SBP <70 mm Hg) with low total peripheral resistance, refractory to other sympathomimetic amines

CONTRAINDICATIONS

Hypotensive patients with hypovolemia (relative contraindication)

ADVERSE REACTIONS

Headache
Dysrhythmias
Tachycardia
Reflex bradycardia
Angina pectoris
Hypertension

DRUG INTERACTIONS

Norepinephrine can be deactivated by alkaline solutions.
MAO inhibitors and bretylium may potentiate the effects of catecholamines.
Beta-adrenergic antagonists may blunt inotropic response.
Sympathomimetics and phosphodiesterase inhibitors may exacerbate dysrhythmia response.

HOW SUPPLIED

1 mg/mL, 4-mL ampule

DOSAGE AND ADMINISTRATION

Adult: Dilute 4 mg in 250 mL of D_5W or D_5NS (16 mcg/mL); begin infusion at 0.1-0.5 mcg/kg/min (up to 30 mcg/min) titrated to desired effect (average adult dose is 7-35 mcg/min); poison/drug-induced hypotension may require higher doses to achieve adequate perfusion
Pediatric: Begin at 0.1-2 mcg/kg/min IV/IO; adjust infusion rate to achieve desired change in blood pressure and systemic perfusion.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Norepinephrine may cause fetal anoxia when used in pregnancy.
Infuse norepinephrine through a large, stable vein to avoid extravasation and tissue necrosis.
Use infusion pump to ensure precise flow rate.
Do not administer in same IV line as alkaline solutions.
May induce dysrhythmias.

ONDANSETRON (ZOFRAN, ZUPLENZ)

CLASS

Antiemetic

DESCRIPTION

Ondansetron is an oral and parenteral antiemetic agent. It is the first selective serotonin blocking agent to be marketed. The primary use of the drug is to manage nausea and vomiting in postoperative patients and in those undergoing chemotherapy. Ondansetron preferentially blocks the serotonin 5-HT_3 receptors. These receptors are found centrally in the chemoreceptor trigger zone and peripherally at vagal nerve terminals in the intestines.

ONSET AND DURATION

Onset: Within 30 min
Duration: 3-6 hr

INDICATIONS

Nausea
Vomiting

CONTRAINDICATIONS

Hypersensitivity to the drug
Liver disease
GI obstruction

ADVERSE REACTIONS

Generally well tolerated
ECG irregularities (rare)
Hiccups
Pruritus
Flushing
Chills
Headache
Dizziness
Drowsiness
Extrapyramidal symptoms
Shivering
Hypoxia

DRUG INTERACTIONS

None significant in emergency care

HOW SUPPLIED

Tablet: 4, 8, 24 mg
Dissolving film and tablets: 4, 8 mg
Oral solution: 4 mg/5 mL
Solution for injection: 2 mg/mL

DOSAGE AND ADMINISTRATION (ADULT; PARENTERAL, ORAL)

IV: Up to 4 mg may be given undiluted; inject over 30 sec (2-5 min preferred)
Infusion (available in a premix or dilute dose in 50 mL of D_5W): Infuse over 15 min
IM: 4 mg, single injection in well-developed muscle
Oral film and tablets: Adults 4 mg PO
Safety in children not established.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
The use of ondansetron may mask the symptoms of adynamic ileus, GI obstruction, or gastric distention after abdominal surgery.
Tablets should be gently removed from foil; not pushed through package. Allow to dissolve on tongue with saliva.

OXYGEN

CLASS

Naturally occurring atmospheric gas

DESCRIPTION

Oxygen is an odorless, tasteless, colorless gas that is present in room air at a concentration of approximately 21%. Oxygen is an important emergency drug used to reverse hypoxemia; in doing so, it helps oxidize glucose to produce adenosine triphosphate (aerobic metabolism). Oxygen may help reduce the size of infarcted tissue during an acute myocardial infarction (in patients who are hypoxemic on room air).

ONSET AND DURATION

Onset: Immediate
Duration: Less than 2 min

INDICATIONS

Any suspected cardiopulmonary emergency
Confirmed or suspected hypoxia
Ischemic chest pain
Respiratory insufficiency
Suspected stroke or ACS with hypoxemia (when oxygen saturation is unknown or <94%)
Prophylactically during air transport
Confirmed or suspected carbon monoxide poisoning and other causes of decreased tissue oxygenation (cardiac arrest)

CONTRAINDICATIONS

Oxygen should never be withheld in any critically ill patient.

ADVERSE REACTIONS

High-concentration oxygen may cause decreased level of consciousness and respiratory depression in patients with chronic carbon dioxide retention.

DRUG INTERACTIONS

None significant

HOW SUPPLIED

Oxygen cylinders (usually green and white) or wall-mounted delivery devices that supply 100% compressed oxygen gas

DOSAGE AND ADMINISTRATION

Adult and child:
- Administer highest possible concentration during initial evaluation and stabilization; then administer to maintain oxygen saturation of 94-99%
- High-concentration: 10-15 L/min via nonrebreather mask or high-flow oxygen delivery device
- Low concentration: 1-4 L/min via nasal cannula
- Venturi mask concentrations (e.g., 24%, 28%, 32%, 36%) for intermediate rates of oxygen administration in patients with chronic obstructive pulmonary disease

SPECIAL CONSIDERATIONS

Pregnancy safety: NA
Oxygen vigorously supports combustion.

OXYTOCIN (PITOCIN)

CLASS

Pituitary hormone

DESCRIPTION

Oxytocin means "rapid birth" and is a synthetic hormone named for the natural posterior pituitary hormone. It stimulates uterine smooth muscle contractions and helps expedite the normal contractions of a spontaneous labor. As with all significant uterine contractions, a transient reduction in uterine blood flow occurs. Oxytocin also stimulates the mammary glands to increase lactation, without increasing the production of milk. The drug is administered in the prehospital setting to control postpartum bleeding.

ONSET AND DURATION

Onset: (IV) Immediate; (IM) within 3-5 min
Duration: (IV) 20 min after the infusion is stopped; (IM) 30-60 min

INDICATIONS

Postpartum hemorrhage after infant and placental delivery

CONTRAINDICATIONS

Hypertonic or hyperactive uterus
Presence of a second fetus
Fetal distress

ADVERSE REACTIONS

Hypotension
Tachycardia
Hypertension
Dysrhythmias
Angina pectoris
Anxiety
Seizure
Nausea and vomiting
Allergic reaction
Uterine rupture (from excessive administration)

DRUG INTERACTIONS

Vasopressors may potentiate hypertension

HOW SUPPLIED

10 USP units/1-mL ampule (10 units/mL) and prefilled syringe 5 USP units/1-mL ampule (5 units/mL) and prefilled syringe

DOSAGE AND ADMINISTRATION

Control of Postpartum Hemorrhage
IM: 3-10 units IM following delivery of placenta
Bleeding Following Incomplete or Elective Abortion
IV: Mix 10-40 units (1-4 mL) in 1000 mL of NS or lactated Ringer's; infuse at 10-40 milliunits/min via microdrip tubing, titrated to severity of bleeding and uterine response

SPECIAL CONSIDERATIONS

Pregnancy safety: Category X
Vital signs and uterine tone should be monitored closely.
Oxytocin should be administered only in the prehospital setting after delivery of all fetuses.

PANCURONIUM

CLASS

Neuromuscular blocker (nondepolarizing)

DESCRIPTION

Pancuronium produces complete muscular relaxation by binding to the receptor for acetylcholine at the neuromuscular junction, without initiating depolarization of the muscle membrane. As the concentration of acetylcholine rises in the neuromuscular junction, pancuronium is displaced and muscle tone is regained. Neuromuscular blocking agents are used to provide muscle relaxation during surgery (particularly relaxation of the abdominal muscles) usually with general anesthesia and to prevent convulsive muscle spasms during electroconvulsive therapy. In emergency care, pancuronium is used to optimize conditions for endotracheal intubation and assisted ventilations.

ONSET AND DURATION

Onset: Paralysis in 3-5 min
Duration: 45-60 min

INDICATIONS

Induction or maintenance of paralysis after intubation to assist ventilations

CONTRAINDICATIONS

Known hypersensitivity to the drug
Inability to control airway and/or support ventilations with oxygen and positive pressure
Neuromuscular disease (e.g., myasthenia gravis)

ADVERSE REACTIONS

Transient hypotension
Tachycardia
Dysrhythmias
Hypertension
Excessive salivation
Pain, burning at IV injection site

DRUG INTERACTIONS

Positive chronotropic drugs may potentiate tachycardia.

HOW SUPPLIED

1, 2 mg/mL

DOSAGE AND ADMINISTRATION

Adult: 0.04-0.1 mg/kg slow IV; repeat q 30-60 min prn
Pediatric: 0.04-0.1 mg/kg slow IV
Newborn: 0.02 mg/kg dose

NOTE
If the patient is conscious, explain the effects of the medication before administration, and always sedate the patient before using a neuromuscular blocking agent.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Patients must be sedated completely and have an artificial airway during paralysis.
Carefully monitor the patient and be prepared to resuscitate.
The effects of pancuronium are antagonized by neostigmine (Prostigmin) 0.05 mg/kg and should be accompanied by atropine (0.6-1.2 mg IV).
Pancuronium has no effect on consciousness or pain.
Pancuronium will not stop neuronal seizure activity or decrease central nervous system damage caused by seizures.
Heart rate and cardiac output will be increased.
Pancuronium is excreted in the urine; doses should be decreased for patients with renal disease.

NOTE
Neuromuscular blocking agents produce respiratory paralysis. Therefore intubation and ventilatory support must be readily available.

Neuromuscular blocking agents produce respiratory paralysis. Therefore intubation and ventilatory support must be readily available.

PHENYTOIN (DILANTIN)

CLASS

Anticonvulsant

DESCRIPTION

Phenytoin (a hydantoin) is a drug used to control grand mal and focal motor seizure activity when other drugs are not successful. It was developed as an alternative anticonvulsant that would cause less sedation than barbiturates. Phenytoin appears to inhibit the spread of seizure activity by promoting sodium efflux from neurons, thereby stabilizing the threshold of the neuron against excitability caused by excess stimulation. Phenytoin also has been used to treat digitalis-induced atrial and ventricular dysrhythmias by stabilizing the sodium influx in Purkinje fibers of the heart, decreasing abnormal ventricular automaticity, and increasing atrioventricular node conduction.

ONSET AND DURATION

Onset: 20-30 min for seizure disorder
Duration: Several days

INDICATIONS

Major motor seizures (generalized grand mal, simple partial. and complex partial seizures)
Status epilepticus

CONTRAINDICATIONS

Hypersensitivity
Sinus bradycardia
Second- and third-degree heart block
Sinoatrial block

ADVERSE REACTIONS

Hypotension with rapid IV push (greater than 50 mg/min)
Cardiovascular collapse (with rapid IV use)
Dysrhythmias
Bradycardia
Respiratory depression
Central nervous system depression
Ataxia
Nystagmus
Thrombophlebitis
Nausea and vomiting
Pain from injection site

DRUG INTERACTIONS

Anticoagulants, cimetidine, sulfonamides, and salicylates may increase serum phenytoin levels.
Chronic alcohol consumption or use induces metabolism of the drug.
Lidocaine, propranolol, and other beta-blocking agents may increase cardiac depressant effects.
Xanthines may result in decreased phenytoin absorption.
Precipitation may occur when mixed with D_5W.
Phenytoin is incompatible with many solutions and medications.
Anticoagulation is enhanced with warfarin administration.

HOW SUPPLIED

50 mg/mL in 2- and 5-mL ampules, 2-mL prefilled syringe. May be diluted in NS (1-10 mg/mL, per protocol); use in-line filter
IV line should be flushed with 0.9% NS before and after the drug is administered

DOSAGE AND ADMINISTRATION

Seizures
Adult: 1000 mg or 15-20 mg/kg (usual loading dose) slow IV; not to exceed 1 g or rate of 50 mg/min; followed by 100-150 mg/dose at 30-min intervals (max of 1500 mg/24 hr)
Pediatric: 10-20 mg/kg slow IV (<0.5 mg/kg/min) loading dose

SPECIAL CONSIDERATIONS

Pregnancy safety: Category D
Phenytoin normally may have slight yellow color.
Carefully monitor vital signs.
Venous irritation can occur because of the alkalinity of the solution.
Use with caution in patients with pulmonary, cardiovascular, hepatic, or renal insufficiency.
Use large, stable vein for injection (extravasation may cause tissue necrosis).

PRALIDOXIME (2-PAM, PROTOPAM)

CLASS

Cholinesterase reactivator and antidote

DESCRIPTION

Pralidoxime reactivates the enzyme acetylcholinesterase, which allows acetylcholine to be degraded, thus relieving the parasympathetic overstimulation caused by excess acetylcholine. This drug is sometimes combined with atropine in an autoinjector such as the DuoDote autoinjector kit.

ONSET AND DURATION

Onset: Within minutes
Duration: Variable

INDICATIONS

Organophosphate poisoning (after atropine)

CONTRAINDICATIONS

Hypersensitivity to pralidoxime

ADVERSE REACTIONS

Tachycardia
Hypertension
Laryngospasm
Hyperventilation
Muscle weakness
Nausea

DRUG INTERACTIONS

Pralidoxime should not be mixed in the same syringe or solution with any other drug.

HOW SUPPLIED

Emergency single-dose kit containing a 20-mL vial of 1 g of the sterile drug, a 20-mL ampule of sterile diluent, and a 20-mL syringe with needle

DOSAGE AND ADMINISTRATION

Adult: 600 mg IM (usually by autoinjector) or 1-2 g IV over 15-30 min
Pediatric: 20-50 mg/kg IV over 15-30 min

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Each 1 g of sterile powder is diluted with 20 mL of sterile water for injection.
Pralidoxime should be diluted further in 100 mL of NS and given as an IV infusion. Use promptly after reconstitution.
Medical direction may recommend the almost simultaneous administration of atropine.
Pralidoxime is not recommended in carbamate poisoning.
Reduce dosage in cases of known renal insufficiency.

PROCAINAMIDE

CLASS

Antidysrhythmic (Class IA)

DESCRIPTION

Procainamide suppresses phase 4 depolarization in normal ventricular muscle and Purkinje fibers, reducing the automaticity of ectopic pacemakers. It also suppresses reentry dysrhythmias by slowing intraventricular conduction. Procainamide may be effective in treating premature ventricular contractions and recurrent ventricular tachycardia that cannot be controlled with lidocaine.

ONSET AND DURATION

Onset: 10-30 min
Duration: 3-6 hr

INDICATIONS

Numerous dysrhythmias, including stable monomorphic VT with normal Q-T interval and preserved LV function
Reentry SVT uncontrolled by adenosine and vagal maneuvers if normotensive
Stable wide-complex tachycardia of unknown origin
Atrial fibrillation with rapid rate in WPW syndrome

CONTRAINDICATIONS

Second- and third-degree atrioventricular block (without functioning artificial pacemaker)

Digitalis toxicity
Torsades de pointes
Complete heart block
Tricyclic antidepressant toxicity

ADVERSE REACTIONS

Hypotension in patients with impaired LV function
Bradycardia
Reflex tachycardia
Atrioventricular block
Widened QRS complex
Prolonged P-R or Q-T interval
Premature ventricular contractions
Ventricular tachycardia, ventricular fibrillation, asystole
Central nervous system depression
Confusion
Seizure

DRUG INTERACTIONS

Increases effects of skeletal muscle relaxants.
Increases plasma/N-acetylprocainamide (active metabolites) concentrations with cimetidine, ranitidine, beta blockers, amiodarone, trimethoprim, and quinidine.
Use with caution with other drugs that prolong the Q-T interval (e.g., amiodarone).

HOW SUPPLIED

1 g in 10-mL vial (100 mg/mL)
1 g in 2-mL vials (500 mg/mL) for infusion

DOSAGE AND ADMINISTRATION

Adult: 20 mg/min slow IV infusion in recurrent ventricular fibrillation/pulseless ventricular tachycardia (max total: 17 mg/kg; max dose usually 1 g). In urgent situations, up to 50 mg/min may be given to a total dose of 17 mg/kg.
Other indications: 20 mg/min IV infusion until one of the following occurs: dysrhythmia resolves, hypotension, QRS widens by >50% of original width, total dose of 17 mg/kg
Maintenance: Infusion (after resuscitation from cardiac arrest): mix 1 g in 250 mL of solution in D_5W or NS (4 mg/mL), infuse at 1-4 mg/min
Pediatric: Loading dose 15 mg/kg IV/IO; infuse over 30-60 min

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Procainamide has potent vasodilating and negative inotropic effects.
Rapid injection may cause procainamide-induced hypotension.
Carefully monitor vital signs and electrocardiogram (a small amount of QRS complex widening is expected).
Reduce dose in patients with cardiac or renal dysfunction to maximum total dose of 12 mg/kg and maintenance infusion to 1-2 mg/min.
Administer cautiously to patients with asthma, digitalis-induced dysrhythmias, acute myocardial infarction, or cardiac, hepatic, or renal insufficiency.

NOTE
Discontinue if the dysrhythmia is suppressed, hypotension develops, the QRS complex is widened by 50% of its original width, or a total of 1 g has been administered.

PROMETHAZINE (PHENERGAN)

CLASS

Phenothiazine, antihistamine

DESCRIPTION

Promethazine is an H_1-receptor antagonist that blocks the actions of histamine by competitive antagonism at the H_1 receptor. In addition to antihistaminic effects, promethazine also possesses sedative, antimotion, antiemetic, and considerable anticholinergic activity. Promethazine often is administered with analgesics, particularly narcotics, to potentiate their effects, although the occurrence of potentiation is controversial.

ONSET AND DURATION

Onset: IV (rapid)
Duration: 4-6 hr

INDICATIONS

Nausea and vomiting
Motion sickness
Preoperative and postoperative, obstetrical (during labor) sedation
To potentiate the effects of analgesics
Allergic reactions

CONTRAINDICATIONS

Hypersensitivity
Comatose states
Central nervous system depression from alcohol, barbiturates, or narcotics
Signs associated with Reye's syndrome

ADVERSE REACTIONS

Sedation
Dizziness
May impair mental and physical ability
Allergic reactions
Dysrhythmias
Nausea and vomiting
Hyperexcitability
Dystonias
Use in children may cause hallucinations, convulsions, and sudden death

DRUG INTERACTIONS

Concomitant use of central nervous system depressants may have an additive sedative effect.
Increased incidence of extrapyramidal effects occurs when given with some MAO inhibitors.
Concomitant use of epinephrine may decrease blood pressure further.

HOW SUPPLIED

25, 50 mg/mL in 1-mL ampules and Tubex syringes

DOSAGE AND ADMINISTRATION

Adult: 12.5-25 mg IV (dilute in 9 mL of NaCl and give 25 mg or less over 10-15 min) or deep IM (undiluted)
Pediatric: Not indicated in the prehospital setting

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C (generally considered safe for use during labor)
Use caution in patients with asthma, peptic ulcer, and bone marrow depression.
Take care to avoid accidental intraarterial injection. IM injections are the preferred route of administration. (Avoid veins in the hands or wrists.) Give slow IV administration over 1 min.

PROPRANOLOL (INDERAL)

CLASS

Beta-adrenergic blocker, antidysrhythmic (Class II)

DESCRIPTION

Propranolol is a nonselective beta-adrenergic blocker that inhibits chronotropic, inotropic, and vasodilator response to beta-adrenergic stimulation. It slows the sinus rate, depresses atrioventricular conduction, decreases cardiac output, and reduces blood pressure. In addition, propranolol decreases myocardial oxygen demand and reduces the risk of sudden death in patients with acute myocardial infarction.

ONSET AND DURATION

Onset: Within 1-2 hr
Duration: 6-12 hr

INDICATIONS

Hypertension
Angina pectoris
Ventricular tachycardia, ventricular fibrillation, and rapid supraventricular dysrhythmias refractory to other therapies
All patients with suspected MI and unstable angina in the absence of contraindications (can reduce the incidence of VF)
Useful as an adjunctive agent with fibrinolytic therapy (may reduce nonfatal reinfarction and recurrent ischemia)
To convert to normal sinus rhythm or to slow ventricular response (or both) in supraventricular tachydysrhythmias (reentry SVT, atrial fibrillation, or atrial flutter)
To reduce myocardial ischemia in AMI patients with elevated heart rate, blood pressure, or both

CONTRAINDICATIONS

Hemodynamically unstable patients
STEMI if signs of heart failure, low cardiac output, or increased risk for cardiogenic shock are present
Relative contraindications include P-R interval >0.24 sec, second- or third-degree heart block, active asthma, reactive airway disease, severe bradycardia, SBP <100 mm Hg

DRUG INTERACTIONS

Adverse reactions:
Bradycardia
Second- or third-degree atrioventricular block
Asthma
Cardiogenic shock
Pulmonary edema
Uncompensated congestive heart failure
Chronic obstructive pulmonary disease (relative)
Cocaine intoxication
Catecholamine-depleting drugs may potentiate hypotension.
Sympathomimetic effects may be antagonized.
Verapamil may worsen atrioventricular conduction abnormalities.
Succinylcholine effects may be enhanced.
Isoproterenol, norepinephrine, dopamine, and dobutamine may reverse effects of propranolol.
Epinephrine may cause a rise in blood pressure, a decrease in heart rate, and severe vasoconstriction.
Signs of hypoglycemia may be masked.

HOW SUPPLIED

1 mg/mL vials

DOSAGE AND ADMINISTRATION

Adult: 1-3 mg IV over 2-5 min (not to exceed 1 mg/min); can be repeated after 2 min (total dose of 0.1 mg/kg)
Pediatric: Not recommended.

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Propranolol may produce life-threatening side effects; closely monitor patient during administration.
Use with caution in elderly patients.
Use with caution in patients with impaired hepatic or renal function.
Atropine should be readily available.

NOTE
Beta$_1$-selective drugs now available are used more commonly for cardiac emergencies.

RETEPLASE (RETAVASE)

CLASS

Fibrinolytic

DESCRIPTION

Reteplase is a recombinant plasminogen activator. Fibrinolytic action occurs by generating plasmin from plasminogen. Plasmin degrades the fibrin matrix of a thrombus. The drug is used in the management of acute myocardial infarction in adults, for the improvement of ventricular function following acute myocardial infarction, and for a reduction in the incidence of congestive heart failure. Treatment with reteplase should be initiated as soon as possible after the onset of acute myocardial infarction symptoms.

ONSET AND DURATION

Onset: Causes reperfusion within 90 min for most patients
Duration: Variable

INDICATIONS

Management of acute myocardial infarction in adults (must be confirmed with 12-lead ECG)

CONTRAINDICATIONS

Active internal bleeding
History of stroke
Recent intracranial or intraspinal surgery or trauma
Intracranial neoplasm, atrioventricular malformation, or aneurysm
Bleeding disorders
Severe uncontrolled hypertension

ADVERSE REACTIONS

Bleeding (internal and at superficial sites)
Reperfusion dysrhythmias
Allergic reaction (rare)
Nausea and vomiting
Hypotension

DRUG INTERACTIONS

Risk of bleeding will be increased if used concurrently with drugs that alter platelet function.
Risk of bleeding with concomitant use of heparin, vitamin K antagonist (e.g., warfarin) is greatly increased.
Reteplase is incompatible with heparin; do not administer in the same IV line.

HOW SUPPLIED

Supplied in kit with components for reconstitution: single-use reteplase vials (10.8 units each), single-use diluent vials of sterile water (10 mL each), sterile 10-mL syringes with 20-gauge needles, sterile dispensing pins, sterile 20-gauge needles for administration, and alcohol swabs. Reconstitute by withdrawing 10 mL of diluent; open the package containing the dispensing pin; remove the needle from the syringe and discard the needle; remove the connective cap from the dispensing pin and connect the syringe to the pin; remove the flip cap from one vial of reteplase; remove the protective cap from the spike end of the dispensing pin and insert the spike into the vial of reteplase; transfer the diluent through the dispensing pin into the vial of reteplase; with the dispensing pin and syringe still attached, swirl (not shake) the vial gently to dissolve the reteplase; withdraw 10 mL of the reconstituted solution back into the syringe; detach the syringe from the dispensing pin, and attach a sterile 20-gauge needle; the 10-mL bolus dose is now ready to administer.

DOSAGE AND ADMINISTRATION

Adult: Administered 10 units as IV bolus over 2 min; administer a second 10-unit IV bolus in 30 min. (Give NS flush before and after each bolus.) Heparin and aspirin should be administered concomitantly.
Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Reteplase should be given in an IV line in which no other medication is being injected or infused simultaneously.
Protect contents of package from light.

SODIUM BICARBONATE

CLASS

Buffer, alkalinizing agent, electrolyte supplement

DESCRIPTION

Sodium bicarbonate reacts with hydrogen ions to form water and carbon dioxide and thereby can act to buffer metabolic acidosis. As the plasma hydrogen ion concentration decreases, blood pH rises.

ONSET AND DURATION

Onset: 2-10 min
Duration: 30-60 min

INDICATIONS

Tricyclic antidepressant overdose
Known preexisting hyperkalemia
Known preexisting bicarbonate responsive acidosis
Intubated patient with continued long arrest interval, pulseless electrical activity
Alkalinization for treatment of specific intoxications/rhabdomyolysis
Management of metabolic acidosis
Diabetic ketoacidosis

CONTRAINDICATIONS

Not effective in hypercarbic acidosis (e.g., cardiac arrest and CPR without intubation)
In patients with chloride loss from vomiting and gastrointestinal suction
Metabolic and respiratory alkalosis
Severe pulmonary edema
Abdominal pain of unknown origin
Hypocalcemia
Hypokalemia
Hypernatremia
When administration of sodium could be detrimental

ADVERSE REACTIONS

Metabolic alkalosis
Hypoxia
Rise in intracellular P_{CO_2} and increased tissue acidosis
Electrolyte imbalance (hypernatremia)
Seizures
Tissue sloughing at injection site

DRUG INTERACTIONS

Sodium bicarbonate may precipitate in calcium solutions. Alkalinization of urine may shorten elimination half-lives of certain drugs.
Vasopressors may be deactivated.

HOW SUPPLIED

50 mEq in 50 mL; 0.5, 0.6 mEq/mL

DOSAGE AND ADMINISTRATION

Urgent Forms of Metabolic Acidosis/Severe Hyperkalemia
Adult: 1 mEq/kg IV
Pediatric: Same as adult; infuse slowly and only if ventilations are adequate

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Not recommended for routine use in cardiac arrest patients.
When possible, blood gas analysis should guide bicarbonate administration.
Bicarbonate administration produces carbon dioxide, which crosses cell membranes more rapidly than bicarbonate (potentially worsening intracellular acidosis).
Sodium bicarbonate may increase edematous or sodium-retaining states.
Sodium bicarbonate may worsen congestive heart failure.
Maintain adequate ventilation (gas exchange).

SOTALOL (BETAPACE, SORINE)

CLASS

Beta blocker, Class III antidysrhythmic

DESCRIPTION

Sotalol is a nonselective beta-adrenergic blocking agent used to treat ventricular and supraventricular dysrhythmias in patients without structural heart disease. The drug has both type II (beta-blocking) and type III (cardiac action potential elongation) properties. Because of this, sotalol is used in the treatment of atrial dysrhythmias or life-threatening ventricular dysrhythmias, including sustained ventricular tachycardia. It should not be used for mild dysrhythmias because it is known to be proarrhythmic, with an increased risk for torsades de pointes. It should also be avoided in patients with poor perfusion because of its significant negative inotropic effects.

ONSET AND DURATION

Onset: Rapid
Duration: 8-16 hr

INDICATIONS

Ventricular and atrial dysrhythmias
SVTs in patients without structural heart disease

CONTRAINDICATIONS

Bronchial asthma
Sinus bradycardia
Second- and third-degree AV block (unless a functioning pacemaker is present)
Congenital or acquired long QT syndromes
Cardiogenic shock
Uncontrolled congestive heart failure
Hypersensitivity to sotalol

ADVERSE REACTIONS

Bradycardia
Heart blocks
Hypotension
QT prolongation
Syncope
Torsades de pointes
Ventricular dysrhythmias

DRUG INTERACTIONS

Most drug interactions with sotalol occur via enhanced pharmacological and electrophysiological effects (beta blockade, QT prolongation, AV blockade) with other drugs.
Proarrhythmic events are common. Use caution when administering sotalol together with calcium channel blockers such as verapamil and diltiazem because concomitant use may have additive effects on AV conduction, ventricular function, and blood pressure. Use caution when administering sotalol together with beta agonists such as albuterol, terbutaline, and isoproterenol.

HOW SUPPLIED

Tablet: 80, 120, 160, 240 mg
Solution for injection: 150 mg/10 mL

DOSAGE AND ADMINISTRATION (IV)

1-1.5 mg/kg; follow protocol for infusion rate

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
As with all beta blockers, sotalol may worsen congestive heart failure because of impaired ventricular contraction or decreased ejection fraction.
Doses should be reduced in patients with renal impairment.

STREPTOKINASE (STREPTASE)

CLASS

Fibrinolytic agent

DESCRIPTION

Streptokinase combines with plasminogen to produce an activator complex that converts free plasminogen to the proteolytic enzyme plasmin. The plasmin in turn functions as an enzyme that degrades fibrin threads and fibrinogen, causing lysis of the blood clot. Streptokinase is administered to selected patients with acute myocardial infarction.

ONSET AND DURATION

Onset: 10-20 min (fibrinolysis, 10-20 min; clot lysis, 60-90 min)
Duration: 3-4 hr (prolonged bleeding times up to 24 hr)

INDICATIONS

Acute myocardial infarction
Massive pulmonary emboli
Arterial thrombosis and embolism
To clear arteriovenous cannulae
Deep venous thrombosis (rare)

CONTRAINDICATIONS

Hypersensitivity
Active bleeding
Recent surgery (within 2-3 weeks)
Recent cerebrovascular accident
Prolonged cardiopulmonary resuscitation
Intracranial or intraspinal surgery
Recent significant trauma (particularly head trauma)
Uncontrolled hypertension (systolic pressure ≥180 mm Hg; diastolic pressure ≥110 mm Hg)

ADVERSE REACTIONS

Bleeding (gastrointestinal, genitourinary, intracranial, other sites)
Allergic reactions
Hypotension
Chest pain
Reperfusion dysrhythmias
Abdominal pain

DRUG INTERACTIONS

Acetylsalicylic acid may increase risk of bleeding (and may be beneficial in improving overall effectiveness).
Heparin and other anticoagulants may increase risk of bleeding and improve overall outcome.

HOW SUPPLIED

250,000, 750,000, and 1,500,000 unit vials
Reconstitute by slowly adding 5 mL of sodium chloride or D_5W, directing the stream toward the side of the vial, rather than into the powder. Gently roll—do not shake—the vial for reconstitution. Slowly dilute the entire contents of the vial to a total of 45 mL.

DOSAGE AND ADMINISTRATION

Acute Myocardial Infarction
Adult: 1.5 million units diluted to 45 mL (IV) over 1 hr (use infusion pump)
Pediatric: Safety not established

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Do not administer IM injections to patients receiving fibrinolytic drugs.
Obtain blood sample for coagulation studies before administration.
Carefully monitor vital signs.
Observe the patient for bleeding.
Use caution when moving patient to avoid bruising or bleeding.
Do not draw arterial blood gas specimens in fibrinolytic therapy candidates.
Use one IV line exclusively for fibrinolytic administration.

SUCCINYLCHOLINE (ANECTINE)

CLASS

Neuromuscular blocker (depolarizing)

DESCRIPTION

Succinylcholine has the quickest onset and briefest duration of action of all neuromuscular blocking drugs, making it a drug of choice for procedures such as endotracheal intubation, electroconvulsive shock therapy, and terminating laryngospasm. Like nondepolarizing blockers, depolarizing drugs also bind to the receptors for acetylcholine. However, because they cause depolarization of the muscle membrane, they often lead to fasciculations and some muscular contractions.

ONSET AND DURATION

Onset: Less than 1 min
Duration: 5-10 min after single IV dose

INDICATIONS

To facilitate intubation
Terminating laryngospasm
Muscle relaxation

CONTRAINDICATIONS

Burns or injuries in the first 12 hr
Hypersensitivity
Skeletal muscle myopathies
Inability to control airway and/or support ventilations with oxygen and positive pressure
Personal or family history of malignant hyperthermia
Acute rhabdomyolysis
Intraocular (globe rupture) injuries

ADVERSE REACTIONS

Hypotension
Respiratory depression
Bradycardias
Dysrhythmias
Initial muscle fasciculation
Excessive salivation
Malignant hyperthermia
Allergic reaction
Succinylcholine may exacerbate hyperkalemia in trauma patients (hours after trauma).

DRUG INTERACTIONS

Oxytocin, beta blockers, chronic contraceptive use, and organophosphates may potentiate effects.
Diazepam may reduce duration of action.
Cardiac glycosides may induce dysrhythmias.

HOW SUPPLIED

20, 100 mg/mL; 1-g multidose vial

DOSAGE AND ADMINISTRATION

NOTE
If the patient is conscious, explain the effects of the medication before administration. Premedication with atropine should be strongly considered, particularly in the pediatric age group. Premedicating with lidocaine may blunt any increase in intracranial pressure associated with intubation. Finally, diazepam or another sedative should be used in any conscious patient before undergoing neuromuscular blockade.

Adult: 0.3-1.1 mg/kg (25-75 mg) over 10-30 sec IV; 0.04-0.07 mg/kg to maintain relaxation
Pediatric: 1-2 mg/kg dose rapid IV; max 150 mg
Rapid Sequence Intubation
1-1.5 mg/kg IV/IO for adults and children; 2 mg/kg IV/IO for infants

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C

NOTE
Neuromuscular blocking agents will produce respiratory paralysis. Therefore intubation and ventilatory support must be readily available.

Carefully monitor the patient and be prepared to resuscitate. Administer with caution to patients with severe trauma, burns, and electrolyte imbalances (high potassium levels).
Brain or spinal cord injury may prolong effects.
Patients must have a patent or artificial airway and adequate sedation during paralysis. Children are not as sensitive to succinylcholine on a weight basis as adults and may require higher doses.
Succinylcholine has no effect on consciousness or pain.
Succinylcholine will not stop neuronal seizure activity.
Succinylcholine rarely may cause ventricular dysrhythmias/cardiac arrest in infants and children.

TENECTEPLASE (TNK-TPA)

CLASS

Fibrinolytic

DESCRIPTION

Tenecteplase is a modified form of human tissue plasminogen activator (tPA) that binds to fibrin and converts plasminogen to plasmin. The drug has been mass produced using recombinant DNA technology. The enzyme binds to fibrin-bound plasminogen at the site of an arterial clot, thus converting plasminogen to plasmin. Plasmin digests the fibrin strands of the clot, causing clot lysis and restoration of perfusion to the occluded artery. In prehospital care, fibrinolytic agents are used in treating selected patients with acute evolving myocardial infarction (STEMI).

INDICATIONS

AMI with ST-elevation (STEMI) attributable to coronary artery thrombosis

CONTRAINDICATIONS

Active bleeding or known bleeding disorder
Recent surgery (within 2-3 weeks)
Recent cerebrovascular accident
History of intracranial hemorrhage
Prolonged cardiopulmonary resuscitation
Recent intracranial or intraspinal surgery
Recent significant trauma (particularly head trauma)
Seizure at onset of stroke symptoms
Uncontrolled hypertension
Recent gastrointestinal bleeding

ADVERSE REACTIONS

Bleeding (gastrointestinal, genitourinary, intracranial, other sites)
Allergic reactions
Hypotension
Chest pain
Reperfusion dysrhythmias
Abdominal pain

DRUG INTERACTIONS

Use with caution in patients who have recently received glycoprotein IIb/IIIa inhibitors or anticoagulants (e.g., warfarin) because of the potential for enhanced effects on hemostasis.
Platelet aggregation may be impaired by serotonin norepinephrine reuptake inhibitors (SNRIs).

HOW SUPPLIED

50-mg powder for injection; reconstitute by using the diluent, syringe, needle, and dispensing system provided by the manufacturer. Reconstitute only with 10 mL of sterile water for injection without preservatives. Gently swirl the vial until contents are completely dissolved. Do not shake. The reconstituted vial will be a colorless to pale yellow transparent solution containing TNKase at 5 mg/mL.

DOSAGE AND ADMINISTRATION

Adult: IV bolus over 5 sec
Weight adjusted: <60 kg, give 30 mg; 60-69 kg, give 35 mg; 70-79 kg, give 40 mg; 80-89 kg, give 45 mg; ≥90 kg, give 50 mg
Pediatric: Not indicated

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Incompatible with dextrose solutions.
Administer via a dedicated IV line in which no other medications are being simultaneously injected or infused.

TETRACAINE (PONTOCAINE)

CLASS

Topical ophthalmic anesthetic

DESCRIPTION

Tetracaine is used for rapid, brief superficial anesthesia. The agent inhibits conduction of nerve impulses from sensory nerves.

ONSET AND DURATION

Onset: Within 30 sec
Duration: 10-15 min

INDICATIONS

Short-term relief from eye pain or irritation
Patient comfort before eye irrigation

CONTRAINDICATIONS

Hypersensitivity to tetracaine
Open injury to the eye

ADVERSE REACTIONS

Burning or stinging sensation
Irritation

DRUG INTERACTIONS

Incompatible with mercury or silver salts often found in ophthalmic products

HOW SUPPLIED

0.5% solution

DOSAGE AND ADMINISTRATION

Adult: 1-2 drops
Pediatric: Same as adult

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Tetracaine can cause epithelial damage and systemic toxicity.
Tetracaine is not recommended for prolonged use.

THIAMINE (BETAXIN)

CLASS

Vitamin (B_1)

DESCRIPTION

Thiamine combines with adenosine triphosphate to form thiamine pyrophosphate, a coenzyme necessary for carbohydrate metabolism. Most vitamins required by the body are obtained through diet; however, certain states such as alcoholism and malnourishment may affect the intake, absorption, and utilization of thiamine. The brain is extremely sensitive to thiamine deficiency.

ONSET AND DURATION

Onset: Rapid
Duration: Depends on the degree of deficiency

INDICATIONS

Coma of unknown origin (with administration of dextrose 50% or naloxone)
Delirium tremens

Beriberi (rare)
Wernicke's encephalopathy

CONTRAINDICATIONS

None significant

ADVERSE REACTIONS

Hypotension (from rapid injection or large dose)
Anxiety
Diaphoresis
Nausea and vomiting
Allergic reaction (usually from IV injection; rare); angioedema

DRUG INTERACTIONS

None significant

HOW SUPPLIED

1-, 2-mL vials (100 mg/mL)

DOSAGE AND ADMINISTRATION

Adult: 100 mg slow IV or IM
Pediatric: Not recommended in the prehospital setting

SPECIAL CONSIDERATIONS

Pregnancy safety: Category A (Category C if dose exceeds recommended daily allowance)
Large IV doses may cause respiratory difficulties.
Anaphylactic reactions have been reported.

TIROFIBAN (AGGRASTAT)

CLASS

Glycoprotein IIb/IIIa inhibitor

DESCRIPTION

Glycoprotein IIb/IIIa inhibitors inhibit the integrin GP IIb/IIIa receptor in the membrane of the platelets. As a result, they inhibit the common final pathway activation of platelet aggregation. Tirofiban (in combination with aspirin and heparin) is indicated for use in patients who have unstable angina or NSTEMI infarction.

ONSET AND DURATION

Onset: Within 30 min
Duration: Platelet aggregation restored within 4-8 hr after infusion is stopped

INDICATIONS

Patients with NSTEMI or unstable angina undergoing PCI

CONTRAINDICATIONS

Active internal bleeding
Bleeding disorder within the past 30 days
History of intracranial hemorrhage, neoplasm, AV malformation, aneurysm, or stroke within 30 days
Major surgical procedure or trauma within 1 month
Aortic dissection, pericarditis, and severe hypertension
Hypersensitivity to any GP IIb/IIIa inhibitor
Low platelet count

ADVERSE REACTIONS

Anaphylactoid reaction/anaphylactic shock
Bleeding (secondary to drug-induced platelet dysfunction)
GI bleeding
Hematemesis
Hematuria
Hypotension
Intracranial bleeding
Platelet dysfunction
Retroperitoneal bleeding
Stroke
Thrombocytopenia

DRUG INTERACTIONS

Concomitant use of other agents that may affect hemostasis, such as anticoagulants, other platelet inhibitors, NSAIDs, and thrombolytic agents, may be associated with an increased risk of bleeding.

HOW SUPPLIED

Premixed solution for injection: 50 mcg/mL

DOSAGE AND ADMINISTRATION (ADULT)

0.4 mcg/kg/min IV for 30 min; then 0.1 mcg/kg/min IV infusion over 18-24 hr after PCI

SPECIAL CONSIDERATIONS

Pregnancy safety: Category B
The 2004 ACCP guidelines recommend that tirofiban NOT be used in patients undergoing primary PCI.
Reduce dose in patients with impaired renal function.

VASOPRESSIN (PITRESSIN)

CLASS

Naturally occurring antidiuretic hormone

DESCRIPTION

Vasopressin acts by direct stimulation of smooth muscle V_1 receptors. When given in extremely high doses, it acts as a noradrenergic peripheral vasoconstrictor. Vasopressin may be used as an alternative pressor to epinephrine in adult shock-refractory VF; in asystole and PEA; and for hemodynamic support in septic shock.

ONSET AND DURATION

Onset: Immediate
Duration: Variable

INDICATIONS

As an alternative pressor to epinephrine in adult cardiac arrest
Vasodilatory shock

CONTRAINDICATIONS

Responsive patients with coronary artery disease

ADVERSE REACTIONS

Ischemic chest pain
Abdominal distress
Sweating
Nausea and vomiting
Tremors
Bronchial constriction
Uterine contraction

DRUG INTERACTIONS

No significant drug reactions have been reported.

HOW SUPPLIED

20 units/mL

DOSAGE AND ADMINISTRATION

Adult: Ventricular fibrillation/cardiac arrest: 40 units IV/IO push; may replace either first or second dose of epinephrine
Vasodilatory shock: Continuous infusion of 0.02-0.04 unit/min
Child and infant:
Cardiac arrest: 0.4-1 unit/kg IV/IO bolus (max 40 units)
Hypotension (continuous infusion): 0.0002-0.002 unit/kg/min (0.2-2 milliunits/kg/min)

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Vasopressin may increase peripheral vascular resistance and provoke cardiac ischemia and angina.
Not recommended for responsive patients with coronary artery disease.

VECURONIUM

CLASS

Nondepolarizing neuromuscular blocker

DESCRIPTION

Vecuronium bromide is an intermediate-acting, nondepolarizing, neuromuscular blocking agent. Nondepolarizing agents produce skeletal muscle paralysis by blockade at the myoneural junction. Unlike depolarizing agents, vecuronium has little agonist activity, with no depolarizing effect at the motor endplate. Neuromuscular blockade progresses in a predictable order, beginning with muscles associated with fine movements (e.g., eyes, face, and neck); followed by muscles of the limbs, chest, and abdomen; and, finally, the diaphragm. Vecuronium is used to promote skeletal muscle relaxation during surgery, to aid controlled respiration by increasing pulmonary compliance, and to facilitate endotracheal intubation.

ONSET AND DURATION

Onset: Within 1 min
Duration: 25-40 min (dose related)

INDICATIONS

To facilitate intubation
Muscle relaxation

CONTRAINDICATIONS

Bromide hypersensitivity
Inability to control airway and/or support ventilations with oxygen and positive pressure
Bradycardias
Dysrhythmias
Hypotension
Respiratory depression
Muscular disease
Malignant hyperthermia

ADVERSE REACTIONS

Rare hypersensitivity reactions (e.g., bronchospasm, flushing, erythema, urticaria, hypotension, sinus tachycardia)
Excessive doses of vecuronium can cause prolonged apnea, dyspnea, respiratory depression, and/or profound muscular weakness (muscle paralysis).

DRUG INTERACTIONS

Can interact with opiate agonists by increasing the incidence and severity of bradycardia and hypotension.
Administration of IV phenytoin to patients currently receiving vecuronium has been noted to augment the neuromuscular activity of vecuronium.

HOW SUPPLIED

Powder for injection: 10, 20 mg

DOSAGE AND ADMINISTRATION

Neuromuscular Blockade
Adults, adolescents, and children >10 years: 80-100 mcg/kg IV; reconstitute by adding 10 or 20 mL of bacteriostatic water for injection to 10 or 20 mg, respectively, to give a parenteral solution containing 1 mg/mL
Rapid Sequence Intubation
0.1-02 mg/kg IV/IO for adults; 0.1-0.3 mg/kg IV/IO in children

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Reconstituted vecuronium, which has an acid pH, should not be mixed with alkaline solutions (e.g., barbiturate solutions such as thiopental) in the same syringe or administered simultaneously during intravenous infusion through the same needle or through the same intravenous line.

VERAPAMIL (ISOPTIN)

CLASS

Calcium channel blocker (Class IV antidysrhythmic)

DESCRIPTION

Verapamil is used as an antidysrhythmic, antianginal, and antihypertensive agent. It works by inhibiting the movement of calcium ions across cell membranes. The slow calcium ion current blocked by verapamil is more important for the activity of the sinoatrial node and atrioventricular node than for many other tissues in the heart. By interfering with this current, calcium channel blockers achieve some selectivity of action. Verapamil decreases atrial automaticity, reduces atrioventricular conduction velocity, and prolongs the atrioventricular nodal refractory period. In addition, verapamil depresses myocardial contractility, reduces vascular smooth muscle tone, and dilates coronary arteries and arterioles in normal and ischemic tissues. Verapamil may be used as an alternative drug (after adenosine) to terminate reentry SVT with narrow QRS complex and adequate blood pressure and preserved LF function.

NOTE

Some physicians recommend slow IV administration of 500 mg of calcium chloride before the dose of verapamil to minimize the untoward results of hypotension and bradycardia.

ONSET AND DURATION

Onset: 1-5 min
Duration: 30-60 min (may persist longer)

INDICATIONS

Give only to narrow-complex reentry supraventricular tachycardias or known supraventricular dysrhythmias.
Atrial flutter with a rapid ventricular response
Atrial fibrillation with a rapid ventricular response
Multifocal atrial tachycardia
Vasospastic and unstable angina

CONTRAINDICATIONS

Hypersensitivity
Sick sinus syndrome (unless the patient has a functioning pacemaker)
Second- or third-degree heart block
Sinus bradycardia
Hypotension
Cardiogenic shock
Severe congestive heart failure
Wolff-Parkinson-White syndrome with atrial fibrillation or flutter
Patients receiving IV beta blockers
Give with extreme caution to patients receiving oral beta blockers.
Wide-complex tachycardias of uncertain origin (ventricular tachycardia can deteriorate into ventricular fibrillation when calcium channel blockers are given.)

ADVERSE REACTIONS

Dizziness
Headache
Nausea and vomiting
Hypotension
Bradycardia
Complete atrioventricular block
Peripheral edema

DRUG INTERACTIONS

Verapamil increases serum concentration of digoxin.
Beta-adrenergic blockers may have additive negative inotropic and chronotropic effects.
Antihypertensives may potentiate hypotensive effects.

HOW SUPPLIED

Parenteral: 5 mg/2 mL in 2-, 4-, 5-mL vials, or 2-, 4-mL ampules

DOSAGE AND ADMINISTRATION

Adult:
- Initial dose: 2.5-5 mg slow IV bolus over 2 min (over 3 min in older patients)
- Repeat dose: 5-10 mg bolus in 15-30 min after initial dose if needed; or 5 mg bolus every 15 min until a desired response is achieved (max dose 30 mg)

Pediatric: Not recommended in the prehospital setting

SPECIAL CONSIDERATIONS

Pregnancy safety: Category C
Closely monitor patient's vital signs.
Be prepared to resuscitate.
Atrioventricular block or asystole may occur because of slowed atrioventricular conduction.

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