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ADENOSINE (ADENOCARD)

Class
Endogenous nucleotide

Description
Adenosine is primarily formed from the breakdown product of adenosine triphosphate (ATP). Both compounds are found in every cell of the human body and have a wide range of metabolic roles. Adenosine slows tachycardias associated with the AV node via modulation of the autonomic nervous system without causing negative inotropic effects. It acts directly on sinus pacemaker cells and vagal nerve terminals to decrease chronotropic and dromotropic activity. Adenosine is the drug of choice for paroxysmal supraventricular tachycardia (PSVT) and can be used diagnostically for stable, wide complex tachycardias of unknown type after two doses of lidocaine.

Onset & Duration
Onset: almost immediate
Duration: 10 sec

Indications
Conversion of PSVT to sinus rhythm

Contraindications
Second- or third-degree AV block
Sick sinus syndrome
Hypersensitivity to adenosine
Adverse Reactions
Facial flushing
Lightheadedness
Paresthesia
Headache
Diaphoresis
Palpitations
Chest pain
Hypotension
Nausea
Metallic taste
Shortness of breath

Drug Interactions
Methylxanthines (for example, 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 AV-nodal blocking effect of adenosine.

How Supplied
Parenteral for IV injection 3 mg/ml in 2-ml flip-top vials

Dosage and Administration
Adult:

a. 6.0 mg IV/Saline Lock bolus, rapidly, followed by a Normal Saline (0.9 NS) flush.

b. Observe EKG monitor for 1-2 minutes for evidence of cardioversion.

c. If there is no evidence of cardioversion, administer Adenosine 12 mg, IV/Saline Lock bolus, rapidly, followed by a Normal (0.9 NS) flush.
d. If there is still no evidence of cardioversion, repeat Adenosine 12 mg IV/Saline Lock bolus, **rapidly**, followed by a Normal Saline (0.9 NS) flush.

**Pediatric:**

a. 0.1 mg/kg, IV/Saline Lock or IO bolus, **rapidly**, followed by 2-3 ml of Normal Saline (0.9 NS) flush.

b. If this fails to convert the dysrhythmia, Adenosine may be repeated at 0.2 mg/kg, IV/Saline Lock or IO bolus, **rapidly**, followed by 2-3 ml Normal Saline (0.9 NS) flush. Maximum single dose is 12 mg.

**Protocol**

505-A  Supraventricular Tachycardia  
505-B  Ventricular Tachycardia With A Pulse  
558  Pediatric Decompensated Shock

**Special Considerations**

Pregnancy safety: Category C
May produce bronchoconstriction in patients with asthma or bronchopulmonary disease.
At the time of conversion asystole or new rhythms may result. These generally last a few seconds without intervention
Adenosine is not effective in atrial flutter or fibrillation
ALBUTEROL (PROVENTIL, VENTOLIN)

Class
Relatively selective beta-2 adrenergic bronchodilator

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 & Duration
Onset: 5-15 min. after inhalation; 30 min PO
Duration: 3-4 hr after inhalation; 4-6 hr PO

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

Contraindications
Prior hypersensitivity reaction to albuterol
Cardiac dysrhythmias associated with tachycardia
Tachycardia caused by digitalis intoxication

Adverse Reactions
Tachycardia
Restlessness
Apprehension
Headache
Dizziness
Nausea
Palpitations
Increase in blood pressure
Dysrhythmias
Hypokalemia
Drug Interactions

Sympathomimetics may exacerbate adverse cardiovascular effects. Antidepressants may potentiate the effects on the vasculature. Beta blockers may antagonize albuterol. Albuterol may potentiate diuretic-induced hypokalemia.

How Supplied

Syrup (as sulfate): 2 mg/5 ml

Tablet (as sulfate): 2 and 4 mg

Tablet/extended release (as sulfate): 4 mg

Rotacaps for inhalation: 200 mcg/capsule

MDI: 90 mcg/metered spray (17-g canister with 200 inhalations)

Solution for aerosolization: 0.5% (5 mg/ml)

Prediluted nebulized solution: 2.5 mg in 3 ml NS (0.083%)

Dosage and Administration

Bronchial asthma

Adult:

Albuterol sulfate solution 0.083% (one unit dose bottle of 3.0 ml), by nebulizer, at a flow rate that will deliver the solution over 5 to 15 minutes. May be repeated twice (total of 3 doses).

Pediatric:

Albuterol sulfate 0.083% (one unit dose bottle of 3.0 ml), by nebulizer, at a flow rate that will deliver the solution over 5-15 minutes. (See Appendix J.) May be repeated twice during transport (total of 3 doses).
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**Special Considerations**

Pregnancy safety: Category C
May precipitate angina pectoris and dysrhythmias
Should be used with caution in patients with diabetes mellitus, hyperthyroidism, prostatic hypertrophy, or seizure disorder
Amiodarone Hydrochloride (Cordarone)

Class
Antiarrhythmic (Vaughan Williams Class III)

Description
Amiodarone is generally considered a class III (VW) antiarrhythmic drug, but it possesses electrophysiologic characteristics of all four Vaughan Williams classes. Amiodarone blocks sodium channels at rapid pacing frequencies, and it exerts a noncompetitive antisypathetic action. One of its main effects, with prolonged administration, is to lengthen the cardiac action potential and produce negative chronotropic effect in nodal tissues. In addition to blocking sodium channels, amiodarone blocks myocardial potassium channels, which contributes to slowing of conduction and prolongation of refractoriness. The antisypathetic action and the block of calcium and potassium channels are responsible for the negative dromotrophic effects on the sinus node and for the slowing of conduction and prolongation of refractoriness in the atrioventricular (AV) node. Its vasodilatory action can decrease cardiac workload and consequently myocardial oxygen consumption.

Onset & Duration
Onset:
Effects are seen 10 minutes after IV administration. Due to rapid distribution, serum concentrations decline to 10% of peak values within 30-45 minutes.

Duration:
Up to 24 hr

Indications
Treatment of refractory VF and VT
Contraindications
None in the treatment of life-threatening dysrhythmias

Adverse Reactions
Bradycardia
Hypotension

Drug Interactions
Solvent used for bolus and drip must be Dextrose 5%
Water only.

How Supplied
Parenteral: 15 mg/ml in 10-ml vials

Dosage and Administration
a. 300 mg diluted up to a total 20 mL of D$_5$W, IV Saline Lock Bolus.
b. If Ventricular Fibrillation or Ventricular Tachycardia recurs administer 150 mg diluted up to a total 10 mL D$_5$W, IV Saline Lock Bolus.

Protocol
503-B Ventricular Fibrillation/Pulseless Ventricular Tachycardia
505-A Supraventricular Tachycardia
553 Pediatric Non-Traumatic Cardiac Arrest

Special Considerations
Pregnancy safety: Category C
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. D50 is used in emergency care to treat hypoglycemia and to manage coma of unknown origin.

**Onset & Duration**
Onset: \(\leq 1\) min.
Duration: Depends on the degree of hypoglycemia

**Indications**
- Hypoglycemia
- Altered level of consciousness
- Coma of unknown etiology
- Seizure of unknown etiology
- Refractory cardiac arrest (controversial)

**Contraindications**
There are no significant contraindications for IV administration of 50% dextrose in emergency care.

**Adverse Reactions**
- Warmth, pain, burning from medication infusion
- Thrombophlebitis
- Rhabdomyolysis

**Drug Interactions**
There are no significant drug interactions with other emergency medications.
How Supplied

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

Dosage and Administration

Adult:

Dextrose 25 gm (50 ml of a 50% solution), IV/Saline Lock bolus.

Pediatric:

Dextrose 0.5 gm/kg, IV/Saline Lock or IO bolus. Use 10% Dextrose in patients less than 6 months of age. Use 25% Dextrose in patients between six (6) months and two (2) years of age. Use 50% Dextrose in patients two (2) years of age or older. Maximum dose is 25 gm. (See Broselow Tape or Appendix J.)

Protocol

503-A  Asystole
503-B  Ventricular Fibrillation/Pulseless Ventricular Tachycardia
503-C  Pulseless Electrical Activity
511    Altered Mental Status
513    Status Epilepticus
553    Pediatric Non-Traumatic Cardiac Arrest
556    Pediatric Altered Mental Status
557    Pediatric Status Epilepticus
Special Considerations

Pregnancy safety: NA
Draw blood sample before administration if possible.
Use blood-glucose reagent strips (Dextrostix) or glucometer before administration if possible.
Extravasation may cause tissue necrosis; use a large vein and aspirate occasionally to ensure route patency.
D50 sometimes precipitates severe neurological symptoms (Wernicke's encephalopathy) in thiamine-deficient patients such as alcoholics. This can be prevented by administering 100 mg, IV of thiamine.
DIAZEPAM (VALIUM AND OTHERS)

Class
Benzodiazepine sedative-hypnotic, anticonvulsant

Description
Diazepam is frequently prescribed to treat anxiety and stress. In emergency care, it is used to treat alcohol withdrawal and grand mal seizure activity. Diazepam acts on the limbic, thalamic, and hypothalamic regions of the CNS to potentiate the effects of inhibitory neurotransmitters, raising the seizure threshold in the motor cortex. It may also be used in conscious patients during cardioversion to induce amnesia and sedation. Though the drug is still widely used as an anticonvulsant, it is relatively weak and of short duration. Rapid IV administration may be followed by respiratory depression and excessive sedation.

Onset & 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
Muscle relaxant
Seizure activity
Preoperative sedation
**Contraindications**

- Hypersensitivity to the drug
- Acute narrow angle glaucoma
- Open angle glaucoma

**Adverse Reactions**

- Hypotension
- Reflex tachycardia
- Respiratory depression
- Ataxia
- Psychomotor impairment
- Confusion
- Nausea

**Drug Interactions**

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

**How Supplied**

- Tablet: 2, 5, 10 mg
- Sustained released capsule: 15 mg
- Parenteral: 5 mg/ml vials, ampules, Tubex
- Oral solution: 1, 5 mg/ml
Dosage and Administration

Seizure Activity:

Adult:

5-10 mg, IV/Saline Lock bolus. Repeat doses of Diazepam 5.0-10 mg, IV/Saline Lock bolus, may be given if seizure activity persists or recurs. (Rate of administration may not exceed 5.0 mg/min.)

Pediatric:

0.1 mg/kg, IV/Saline Lock or IO bolus, slowly, over 2 minutes. Repeat doses of Diazepam 0.1 mg/kg, IV/Saline Lock bolus, slowly, over 2 minutes, may be given if seizures persist. (See Appendix J)

Amnesia for cardioversion and analgesia for burns:

5.0-10 mg, IV/Saline Lock bolus. Repeat doses of Diazepam 5.0-10 mg, IV/Saline Lock bolus, may be given as necessary. (Maximum total dosage is 20 mg)

Protocol

505-A  Supraventricular Tachycardia
505-B  Ventricular Tachycardia With A Pulse/Wide Complex Tachycardia of Uncertain Type
505-C  Brady Dysrhythmias/Complete Heart Block
528    Burns
557    Pediatric Status Epilepticus

Special Considerations

Pregnancy safety: Category D
May cause local venous irritation
Has short duration of anticonvulsant effect
Reduce dose by 50% in elderly patients
Resuscitation equipment should be readily available
DILTIAZEM (CARDIZEM AND OTHERS)

Class

Calcium channel antagonist (Class IV antidysrhythmic)

Description

Diltiazem inhibits calcium ion influx across cardiac and smooth muscle cells, decreasing myocardial contractility and oxygen demand, and dilates coronary arteries and peripheral arterioles. Like other calcium antagonists, diltiazem decreases SA and AV conduction in isolated tissue and has a negative inotropic effect.

Onset & Duration

Onset: 3 minutes
Duration: 1-3 hours

Indication

Vasospastic angina
Classic chronic stable angina
Hypertension
PSVT
Atrial flutter with rapid ventricular response
Atrial fibrillation with rapid ventricular response

Contraindication

Sick sinus syndrome (unless a functioning ventricular pacemaker is present)
Hypotension
Second or third degree AV block
Adverse Reactions

Headache
Fatigue
Drowsiness
Edema
Arrhythmias
CHF
Nausea
Rash

Drug Interactions

Diltiazem may increase serum levels of digoxin. Beta-blockers may prolong cardiac conduction time when used together with diltiazem. Cimetidine may inhibit metabolism and cause diltiazem toxicity.

How Supplied

Injectable: 5mg mL in 5 mL vial

Dosage and Administration

0.25 mg/kg, IV/Saline Lock bolus, slowly, over 2 minutes, monitoring blood pressure continuously.

Protocol

505-A Supraventricular Tachycardia

Special Considerations

Pregnancy safety: Category C
Resuscitation equipment should be readily available
DIPHENHYDRAMINE (BENADRYL)

Class
Antihistamine

Description
Antihistamines prevent the physiological actions of histamine by preventing histamine from reaching H1- and H2-receptor sites. Diphenhydramine also has anticholinergic (drying) and sedative effects. Antihistamines provide short-lived benefits and provide only symptomatic relief. Antihistamine is specific for conditions in which histamine excess is present (for example, acute urticaria) but is adjunctive therapy in the treatment of anaphylactic shock because epinephrine is more effective. Antihistamines are quite specific for reversing extrapyramidal reactions and are probably efficacious as drying agents in upper respiratory and sinus conditions.

Onset & Duration
Onset: Maximal effects 1-3 hr
Duration: 6-12 hr

Indications
Symptomatic relief of allergies
Allergic reactions
Anaphylaxis
Acute dystonic reactions
Motion sickness
Antiparkinsonism

Contraindications
Lower respiratory diseases such as asthma attacks
Newborn or premature infants
Nursing mothers
Hypersensitivity
Narrow-angle glaucoma
Adverse Reactions
Dose-related drowsiness
Sedation
Disrupted coordination
Hypotension
Palpitations
Tachycardia
Bradycardia
Thickening of bronchial secretions
Dry mouth and throat
Epigastric distress

Drug Interactions
CNS depressants and alcohol may have additive effects.
MAO inhibitors may prolong and intensify anticholinergic effects of antihistamines.

How Supplied
Tablet: 25, 50 mg
Capsule: 25, 50 mg
Elixir: 12.5 mg/5 ml
Parenteral: 10, 50 mg/ml vials, prefilled syringe

Dosage and Administration
50 mg, IV/Saline Lock bolus, or IM, if IV/Saline Lock bolus has not been established.

Protocol
510 Anaphylactic Reaction

Special Considerations
Pregnancy safety: Category B
DOPAMINE (INTROPIN)

Class
Sympathomimetic

Description
Dopamine is chemically related to epinephrine and norepinephrine. It acts primarily on alpha-1 and beta-1 adrenergic receptors, increasing systemic vascular resistance and exerting a positive inotropic effect on the heart. In addition, the actions of this drug on dopaminergic receptors dilate renal and splanchnic vasculature, maintaining blood flow. Dopamine is commonly used to treat hypotension associated with cardiogenic shock.

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

Indications
Hypotension
Shock
Low cardiac output states

Contraindications
Patients with pheochromocytoma

Adverse Reactions
Dose-related tachydysrhythmias
Hypertension
Increased myocardial oxygen demand
Drug Interactions
May be deactivated by alkaline solutions (sodium bicarbonate and furosemide)
MAO inhibitors and bretylium 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 mg/5 ml, 400 mg/5 ml prefilled syringe and ampule for IV infusion (IV piggyback)

Dosage and Administration

5.0 mcg/kg/min., IV/Saline Lock drip. If there is insufficient improvement in hemodynamic status, the infusion may be increased until the desired therapeutic effects are achieved or adverse effects appear. (Maximum dosage is 20 mcg/kg/min., IV/Saline Lock drip.)

Usually prepared by placing 800 mg in 500 ml D5W to achieve a concentration of 1600 mcg/ml or 200 mg in 250 ml D5W to achieve a concentration of 800 mcg/ml; infuse at 2.5-20 mcg/kg/min. (titrate to patient response)

Dopaminergic response: 2-4 mcg/kg/min.
Beta-adrenergic response: 5-10 mcg/kg/min.
Adrenergic response: 10-20 mcg/kg/min.

Protocol
503-C Pulseless Electrical Activity
504-B Cardiogenic Shock
505-C Brady Dysrhythmias and Complete Heart Block
510 Anaphylactic Reaction
Special Considerations

Pregnancy safety: Category C
Infuse through a large, stable vein to avoid the possibility of extravasation injury
Monitor patient for signs of compromised circulation
**EPINEPHRINE (ADRENALIN)**

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**Class**

Sympathomimetic

---

**Description**

Epinephrine stimulates alpha, beta-1, and beta-2 adrenergic receptors in dose-related fashion. It is the initial drug of choice for treating bronchoconstriction and hypotension resulting from anaphylaxis as well as all forms of cardiac arrest. It is useful in managing reactive airway disease, but beta-adrenergic agents are often used initially because of their bronchial specificity and oral inhalation route. Rapid injection produces a rapid increase in systolic 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.

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**Onset & Duration**

Onset: (SQ) 5-10 min. (IV) 1-2 min.

Duration: 5-10 min.

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**Indications**

Bronchial asthma  
Acute allergic reaction  
Cardiac arrest  
Asystole  
Pulseless electrical activity  
Ventricular fibrillation unresponsive to initial defibrillatory attempts

---

**Contraindications**

Hypersensitivity  
Hypovolemic shock  
Narrow angle glaucoma
**Adverse Reactions**

- Headache
- Nausea
- Restlessness
- Weakness
- Dysrhythmias
- Hypertension
- Precipitation of angina pectoris

**Drug Interactions**

- MAO inhibitors and bretylium 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) 0.5 mg/ml (1:2000) 0.01 mg/ml (1:100,000) pediatric

**Dosage and Administration**

**Adult:**

- **Asystole, pulseless electrical activity, or ventricular fibrillation:**
  
  1 mg (10 ml of a 1:10,000 solution), IV/Saline Lock bolus. If there is no change in the rhythm within 3-5 minutes repeat Epinephrine 1.0 mg (10 ml of a 1: 10,000 solution), IV/Saline Lock bolus, every 3-5 minutes.

  If there is no change in rhythm, repeat Epinephrine 3.0 mg (3 ml of a 1:1,000 solution), IV/Saline Lock bolus, 3-5 minutes after the initial dose. If there is still no change
In путьам, administer epinephrine 5.0 mg (5.0 ml of a 1:1,000 solution), IV/Saline Lock bolus, 3-5 minutes after the previous dose. Subsequent doses of Epinephrine 5.0 mg (5 ml of a 1:1,000 solution), IV/Saline Lock bolus, should be given every 3-5 minutes for the duration of treatment.

**Bradycardia refractory to other interventions:**

Epinephrine 1.0 mcg/min., IV/Saline Lock drip. Prepare the infusion by adding 1.0 mg of Epinephrine (1.0 ml of a 1:1,000 solution) to 250 ml of Normal Saline (0.9 NS) (1 mcg/min. = 15 ml/hr = 15 gtt/min.). If there is sufficient improvement in hemodynamic status, the infusion may be increased until the desired effects are achieved or adverse effects appear. (Maximum dosage is 10 mcg/min., IV/Saline Lock drip.)

**Asthma:**

Epinephrine 0.3 mg (0.3 ml of a 1:1,000 solution), subcutaneously.

**Anaphylactic Reaction:**

Epinephrine 1.0 mg (10 ml of a 1:10,000 solution), via the Endotracheal Tube

If Endotracheal Intubation has not been accomplished, administer Epinephrine 0.3 mg (0.3 ml of a 1:1,000 solution), subcutaneously.

Epinephrine 1.0 mcg/min., IV/Saline Lock drip. Prepare infusion by adding 1.0 mg of Epinephrine (1.0 ml of a 1:1,000 solution) to 250 ml of Normal Saline (0.9 NS) (1 mcg/min. = 15 ml/hr = 15 gtt/min.). If there is insufficient improvement in hemodynamic status, the infusion may be increased until the desired therapeutic effects are achieved or adverse effects appear. (Maximum dosage is 4.0 mcg/min., IV/Saline Lock drip.)
Pediatric:

Anaphylactic reaction and newborn resuscitation:

Epinephrine 0.1 mg/kg (0.1 ml/kg of a 1:1,000 solution), IV/Saline Lock, IO, or ET.

Asthma:

In patients one (1) year of age or older with severe respiratory distress, respiratory failure, and/or decreased breath sounds, administer Epinephrine 0.01 mg/kg (0.01 ml/kg of a 1:1,000 solution), subcutaneously. Maximum dose is 0.3 ml. (See Appendix J.)

Protocol

503-A  Asystole
503-B  Ventricular Tachycardia/Pulseless Ventricular Tachycardia
503-C  Pulseless Electrical Activity
505-C  Brady Dysrhythmias and Complete Heart Block
507  Asthma
510  Anaphylactic Reaction
543  Newborn Resuscitation
554  Pediatric Asthma/Wheezing
555  Pediatric Anaphylactic Reaction

Special Considerations

Pregnancy safety: Category C. Syncope has occurred after epinephrine administration to asthmatic children. May increase myocardial oxygen demand.
FUROSEMIDE (LASIX)

Class
Diuretic

Description
Furosemide is a potent diuretic that inhibits the reabsorption of sodium and chloride in the proximal tubule, distal tubule, and the loop of Henle.

Onset & Duration
Onset: (PO) 30-60 min., (IV) 5 min.
Duration: 2 hr

Indications
Edema
Congestive heart failure
Hypertension

Contraindications
Anuria
Hypersensitivity

Adverse Reactions
Hypotension
Dehydration
Dry mouth
Ototoxicity
Tinnitus
Hypochloremia
Hypokalemia
Hyponatremia
Hyperglycemia
Drug Interactions

Digitalis toxicity may be potentiated by the potassium depletion that can result from furosemide administration. Increases the ototoxic potential of aminoglycoside antibiotics
Lithium toxicity may be potentiated by sodium depletion.

How Supplied

Tablet: 20, 40, 80 mg
Parenteral: 10 mg/ml in 2 ml ampule, 100 mg/ml in 10 ml vial

Dosage and Administration

Furosemide 20-80 mg, IV/Saline Lock bolus.
(Maximum combined total dosage is 80 mg.)

Protocol

506 Acute Pulmonary Edema

Special Considerations

Pregnancy safety: Category C
Furosemide has been known to cause fetal abnormalities
Should be protected from light
GLUCAGON

Class
Pancreatic hormone, insulin antagonist

Description
Glucagon is a hormone secreted by the alpha cells of the pancreas. When released, it elevates blood glucose levels by increasing the breakdown of glycogen to glucose and inhibiting glycogen synthesis. In addition, glucagon exerts positive inotropic action on the heart and decreases renal vascular resistance. The drug is only effective in treating hypoglycemia if liver glycogen is available. Therefore it may be ineffective in chronic hypoglycemia, starvation, and adrenal insufficiency. Glucagon also causes relaxation of smooth muscle of the stomach, duodenum, small bowel, and colon.

Onset & Duration
Onset: Within 1 min.
Duration: 3-6 min.

Indications
Altered level of consciousness where hypoglycemia is suspected.
May be used as an inotropic agent in beta-blocker overdose.

Contraindications
Hypersensitivity
Patients with pheochromocytoma

Adverse Reactions
Tachycardia
Hypertension
Nausea and vomiting
Drug Interactions
There are no significant drug interactions with other emergency medications.

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

Dosage and Administration

Adult:

In patients with diabetic histories where an IV/Saline Lock route is not available, administer Glucagon 1.0 mg, IM. (Thiamine need not be administered to these patients)

Pediatric:

Glucagon 1.0 mg, IM (See Appendix J)

Protocol

| 511 | Altered Mental Status |
| 556 | Pediatric Altered Mental Status |

Special Considerations
Pregnancy safety: Category B
Should not be considered a first-line choice for hypoglycemia
Intravenous glucose must be administered if the patient does not respond to a second dose of glucagon.
LIDOCAINE (XYLOCAINE)

Class
Antidysrhythmic (class Ib)

Description
Lidocaine decreases phase-4 diastolic depolarization and suppresses premature ventricular contractions. In addition, it is used to treat ventricular tachycardia and some cases of ventricular fibrillation. Lidocaine also raises the ventricular fibrillation threshold.

Onset & Duration
Onset: 30-90 sec
Duration: 2-4 hr

Indications
Acute ventricular dysrhythmias

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

Adverse Reactions
Lightheadedness
Confusion
Blurred vision
Hypotension
Cardiovascular collapse
Bradycardia
CNS depression (altered level of consciousness, irritability, muscle twitching, seizures) with high doses
Drug Interactions

Metabolic clearance of lidocaine may be decreased in patients taking beta-adrenergic blockers or in patients with 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.

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

Ventricular fibrillation or pulseless ventricular tachycardia

Adult:

1.5 mg/kg, IV/Saline Lock bolus. Repeat dose may be given after 5 minutes. (Maximum individual dose is 1.5 mg/kg and maximum total dosage is 3.0 mg/kg)

Immediately following conversion to a supraventricular rhythm (even of a short duration), administer Lidocaine 1.5 mg/kg, IV/Saline Lock bolus. Repeat
doses of Lidocaine 0.75 mg/kg, IV/Saline Lock bolus may be given every 5 minutes, and may be followed by Lidocaine 1.0-4.0 mg/min., IV/Saline Lock drip. (Maximum individual dose is 1.5 mg/kg and maximum total dosage is 3.0 mg/kg)

**Pediatric:**

1.0 mg/kg, IV/Saline Lock or IO bolus, or via the Endotracheal Tube. (See Broselow Tape or Appendix J)

**Ventricular ectopy with a pulse**

1.5 mg/kg, IV/Saline Lock bolus. Repeat doses of Lidocaine 0.75 mg/kg, IV/Saline Lock bolus, may be given every 5 minutes. (Maximum individual dose is 1.5 mg/kg and maximum total dosage is 3.0 mg/kg)

If Lidocaine converts the dysrhythmia, administer Lidocaine 1.0-4.0 mg/min., IV/Saline Lock drip.

**Head Injuries**

1.5 mg/kg, IV/Saline Lock bolus immediately prior to intubation to minimize the increase in intracranial pressure. (Maximum dose is 1.5 mg/kg)

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**Protocol**

- **503-B** Ventricular Fibrillation/Pulseless Ventricular Tachycardia
- **504-A** Drug Therapy of Myocardial Ischemia
- **505-B** Ventricular Tachycardia With A Pulse
- **521** Head Injuries
- **553** Pediatric Non-Traumatic Cardiac Arrest

---

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Special Considerations

Pregnancy safety: Category B. Therapeutic plasma levels of lidocaine between 2-6 mcg/ml suppress ventricular dysrhythmias. A 75- to 100-mg bolus maintains adequate blood levels for only 20 min. If bradycardia occurs in conjunction with PVCs, always treat the bradycardia first with atropine, epinephrine, and/or dopamine. Exceedingly high doses of lidocaine can result in coma or death. Avoid lidocaine for reperfusion dysrhythmias after thrombolytic therapy.
LORAZEPAM (ATIVAN AND OTHERS)

**Class**

Benzodiazepine sedative-hypnotic, anticonvulsant

**Description**

Lorazepam is frequently prescribed to treat anxiety and stress. In the emergency setting it is used to treat seizure activity. It depresses the CNS at the limbic and subcortical levels of the brain. It potentiates the effects of inhibitory transmitters, raising the seizure threshold in the motor cortex. The anticonvulsant effect is seen more rapidly, and lasts longer than that of diazepam.

**Onset & Duration**

Onset:

Duration: 6-8 hours

**Indications**

- Acute anxiety states
- Seizure activity
- Premedication before operative procedures
- Muscle relaxant
- Acute alcohol withdrawal

**Contraindications**

- Hypersensitivity
- Acute narrow angle glaucoma

**Adverse Reactions**

- Drowsiness
- Lethargy
- Hypotension
- Respiratory depression

**Drug Interactions**

CNS depression is increased when used concomitantly with alcohol and other CNS depressants.
How Supplied
Tablets: 0.5 mg, 1 mg, 2 mg
Injection: 2 mg/ml, 4 mg/ml

Dosage and Administration

Adult:
2.0-4.0 mg, IV/Saline Lock, or IM. Repeat doses of Lorazepam 2.0-4.0 mg, IV/Saline Lock, or IM, may be given every 5 minutes if seizure activity persists or recurs. (Maximum total dosage is 8.0 mg)

Pediatric:
0.05 mg/kg IV/Saline Lock or IO bolus, slowly, over 2 minutes. Repeat doses of Lorazepam 0.05 mg/kg, IV/Saline Lock or IO bolus, slowly, over 2 minutes, may be given if seizures persist. (See Appendix J)

Protocol
513 Status Epilepticus
557 Pediatric Status Epilepticus

Special Considerations
Pregnancy safety: Category D
Reduce dose by 50% in elderly patients
Resuscitation equipment should be readily available
MAGNESIUM SULFATE

Class
Electrolyte, CNS depressant

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 to manage seizures associated with toxemia of pregnancy. Other uses include uterine relaxation (to inhibit contractions of premature labor), as a bronchodilator after beta-agonist and anticholinergic agents have been used, replacement therapy for magnesium deficiency, as a cathartic to reduce the absorption of poisons from the Gl tract, and in the initial therapy for convulsions. Magnesium sulfate is gaining popularity as an initial treatment in the management of various dysrhythmias, particularly torsades de pointes, and dysrhythmias secondary to a tricyclic antidepressant overdose or digitalis toxicity. The drug is also considered as a class IIa agent (probably helpful) for refractory ventricular fibrillation and ventricular tachycardia after administration of lidocaine or bretylium doses.

Onset & Duration
Onset: Immediate
Duration: 3-4 hr

Indications
Seizures of eclampsia (toxemia of pregnancy)
Torsades de pointes

Contraindications
Heart block
Adverse Reactions
Diaphoresis
Facial flushing
Hypotension
Depressed reflexes
Hypothermia
Reduced heart rate
Circulatory collapse
Respiratory depression

Drug Interactions
CNS depressant effects may be enhanced if the patient is taking other CNS depressants.
Serious changes in cardiac function may occur with cardiac glycosides.

How Supplied
5 and 10 ml of a 10% solution in prefilled syringe

Dosage and Administration
Seizure activity associated with pregnancy:

For severe pre-eclampsia or eclampsia, administer Magnesium Sulfate 2.0 gm, IV/Saline Lock drip, diluted in 50-100 ml of Normal Saline (0.9 NS), over 10-20 minutes.
If seizures develop, continue, or recur in transport, repeat Magnesium Sulfate 2 gm, IV/Saline Lock drip, diluted in 100 ml of Normal Saline (0.9NS), over 10-20 minutes.

Magnesium deficiency related to cardiac dysrhythmias, torsades de pointes, or refractory ventricular fibrillation:

2.0 gm, IV/Saline Lock bolus, diluted in 10 ml of Normal Saline (0.9 NS), over 2 minutes
Asthma:

2.0 gm, IV/Saline Lock drip, diluted in 50-100 ml of Normal Saline (0.9 NS), over 10-20 minutes.

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**Protocol**

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**Special Considerations**

Pregnancy safety: Magnesium sulfate is administered to treat toxemia of pregnancy. It is recommended that the drug not be administered in the 2 hours 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, since it is cleared by the kidneys and can reach toxic levels easily in those patients. Prophylactic administration of magnesium sulfate for patients with acute myocardial infarction should be considered.
METAPROTERENOL (ALUPENT)

Class
Sympathomimetic, bronchodilator

Description
Metaproterenol relaxes the smooth muscles of the bronchial tree and peripheral vasculature by stimulating beta-2 adrenergic receptors of the sympathetic nervous system. It activates adenyl cyclase, the enzyme that catalyzes the conversion of adenosine triphosphate to cyclic adenosine monophosphate.

Onset & Duration
Onset: 5 min. after inhalation
Duration: 4-6 hr

Indications
Bronchial asthma
Reversible bronchospasm (bronchitis, emphysema)

Contraindications
Hypersensitivity
Cardiac dysrhythmias
Tachycardia caused by digitalis toxicity

Adverse Reactions
Restlessness
Tremor
Palpitations
Tachycardia
Dysrhythmias
Decreased blood pressure
Coughing
Facial flushing
Diaphoresis
Drug Interactions

Other sympathomimetics may exacerbate adverse cardiovascular effects. MAO inhibitors may potentiate hypotensive effects. Beta blockers may antagonize metaproterenol.

How Supplied

Tabs: 10, 20 mg
Syrup: 10 mg/5 ml
Inhaler: 650 mcg/metered dose, 300 doses/inhaler (15 ml)
Solution: 0.6% (2.5 ml dose); 5% (0.3 ml dose)

Dosage and Administration

Adult:

5% (0.3 ml in 2.5-3.0 ml of Normal Saline (0.9 NS)), by nebulizer, at a flow rate that will deliver the solution over 5 to 15 minutes. May be repeated twice (total of three doses).

Pediatric:

5% (0.3 ml in 2.5-3.0 ml of Normal Saline (0.9 NS)), by nebulizer, at a flow rate that will deliver the solution over 5-15 minutes. (See Appendix J) May be repeated twice during transport (total of three doses).

Protocol

507 Asthma
554 Pediatric Asthma/Wheezing
Special Considerations

METHYLPREDNISOLONE (SOLU-MEDROL)

Class
Glucocorticoid

Description
Methylprednisolone is a synthetic steroid that suppresses acute and chronic inflammation and may alter the immune response. In addition, it potentiates vascular smooth muscle relaxation by beta-adrenergic agonists and may alter airway hyperactivity. An additional newer use is for reduction of posttraumatic spinal cord edema.

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

Indications
Anaphylaxis
Bronchodilator for unresponsive asthma
Acute spinal cord injury
Endocrine disorders
Rheumatic disorders
Dermatological diseases
Allergic states
Others

Contraindications
Hypersensitivity
Premature infants
Systemic fungal infections
Use with caution in patients with GI bleeding and diabetes mellitus.
Adverse Reactions

Headache
Hypertension
Sodium and water retention
Hypokalemia
Alkalosis
Cataracts
Psychosis
Osteoporosis
Peptic ulcer
Impaired wound healing
Development of Cushingoid state

Drug Interactions

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

How Supplied (methylprednisolone sodium succinate)

40 mg, 125 mg, 500 mg, 1000 mg, 2000 mg/vials

Dosage and Administration

125 mg, IV/Saline Lock bolus, slowly, over 2 minutes, or IM.

Protocol

507 Asthma
508 Chronic Obstructive Pulmonary Disease
510 Anaphylactic Reaction

Special Considerations

Pregnancy safety: Not established.
May mask some signs of infection
MIDAZOLAM HYDROCHLORIDE (VERSED)

Class
Short-acting benzodiazepine CNS depressant

Description
Midazolam HCl is a water-soluble benzodiazepine that may be administered for conscious sedation to relieve apprehension or impair memory before endotracheal or nasotracheal intubation.

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

Indications
Preoperative sedation
Conscious sedation
General anesthesia
Premedication for tracheal intubation

Contraindications
Hypersensitivity
Acute narrow angle glaucoma

Adverse Reactions
Hiccough
Cough
Oversedation
Pain at the injection site
Nausea and vomiting
Headache
Blurred vision
Fluctuations in vital signs
Hypotension
Respiratory depression
Respiratory arrest
Drug Interactions

Sedative effect of midazolam may be accentuated by concomitant use of barbiturates, alcohol, CNS depressants, or narcotics.

How Supplied

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

Dosage and Administration

1.0-2.0 mg, IV/Saline Lock bolus. Repeat doses of Midazolam 1.0 mg IV/Saline Lock bolus, may be given as necessary. (Maximum total dosage is 5.0 mg)

Protocol

505-A  Supraventricular Tachycardia
505-B  Ventricular Tachycardia With A Pulse
505-C  Brady Dysrythmias and Complete Heart Block
528    Burns

Special Considerations

Pregnancy safety: Category D. Administer immediately before the intubation procedure. Provide continuous monitoring of respiratory and cardiac function. Have resuscitation equipment and medication readily at hand.
MORPHINE SULFATE (ASTRAMORPH/PF, AND OTHERS)

Class
Opioid analgesic

Description
Morphine sulfate is a natural opium alkaloid that increases peripheral venous capacitance and decreases venous return ("chemical phlebotomy"). It promotes analgesia, euphoria, and respiratory and physical depression. Secondary pharmacological effects of morphine include depressed responsiveness of alpha-adrenergic receptors (producing peripheral vasodilation) and baroreceptor inhibition. In addition, because morphine decreases both preload and afterload, it may decrease myocardial oxygen demand. Morphine sulfate is a schedule II drug.

Onset & Duration
Onset: Immediate
Duration: 2-7 hr

Indications
Chest pain associated with myocardial infarction
Moderate to severe acute and chronic pain
Should be used with caution in chronic pain syndromes
Pulmonary edema, with or without associated pain

Contraindications
Hypersensitivity
Diarrhea caused by poisoning
Hypovolemia
Hypotension
Head injury or undiagnosed abdominal pain
Patients who have taken MAO inhibitors within 14 days
**Adverse Reactions**

Hypotension  
Nausea and vomiting  
Tachycardia or bradycardia  
Palpitations  
Syncope  
Facial flushing  
Respiratory depression  
Euphoria  
Bronchospasm  
Dry mouth  
Allergic reaction  
Urinary retention

**Drug Interactions**

CNS depressants may potentiate effects of morphine  
(respiratory depression, hypotension, and sedation)  
Chlorpromazine may potentiate analgesia  
MAO inhibitors may cause paradoxical excitation

**How Supplied**

Morphine is supplied in tablets, suppositories, and solution. In emergency care, morphine sulfate is usually 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**

2.0-5.0 mg, IV/Saline Lock bolus. Repeat doses of Morphine Sulfate 2.0-5.0 mg, IV/Saline Lock bolus, may be given as necessary. (Maximum total dosage is 15 mg)

**Protocol**

504-A  Drug Therapy of Myocardial Ischemia  
506  Acute Pulmonary Edema  
528  Burns

Page G. 48
Special Considerations

Pregnancy safety: Category C
Narcotics rapidly cross the placenta. Safety in neonates has not been established. Use with caution in older adults, those with asthma, and those susceptible to CNS depression. May worsen bradycardia or heart block in inferior myocardial infarction (vagotonic effect)
Naloxone and resuscitation equipment should be readily available
NALOXONE (NARCAN)

Class
Synthetic opioid antagonist

Description
Naloxone is a competitive narcotic antagonist used in the management and reversal of overdoses caused by narcotics and synthetic narcotic agents. Unlike other narcotic antagonists, which do not completely inhibit the analgesic properties of opiates, naloxone antagonizes all actions of morphine.

Onset & Duration

Onset: Within 2 min.
Duration: 30-60 min.

Indications
For the complete or partial reversal of CNS and respiratory depression induced by opioids:

Narcotic agonist:

- Morphine sulfate
- Heroin
- Hydromorphone (Dilaudid)
- Methadone
- Meperidine (Demerol)
- Paregoric
- Fentanyl citrate (Sublimaze)
- Oxycodone (Percodan)
- Codeine
- Propoxyphene (Darvon)
Narcotic agonist and antagonist

- Butorphanol tartrate (Stadol)
- Pentazocine (Talwin)
- Nalbuphine (Nubain)

Decreased level of consciousness
Coma of unknown origin
Circulatory support in refractory shock (investigational)

Contraindications

Hypersensitivity
Use with caution in narcotic-dependent patients who may experience withdrawal syndrome (including neonates of narcotic-dependent mothers)

Adverse Reactions

- Tachycardia
- Hypertension
- Dysrhythmias
- Nausea and vomiting
- Diaphoresis

Drug Interactions

Is incompatible with bisulfite and with alkaline solutions.

How Supplied

0.02 mg/ml (neonate), 0.4 mg/ml, 1 mg/ml

Dosage and Administration

Adult:

Asystole, brady dysrhythmias, and complete heart block:

2.0 mg IV/Saline Lock bolus. Repeat doses of Naloxone 2.0 mg, IV/Saline Lock bolus, may be given as necessary. (Maximum total dosage is 10 mg)
Altered mental status:

2.0 mg, IV/Saline Lock bolus. If IV/Saline Lock access has not been established, administer Naloxone 2.0 mg IM.

Pediatric:

2.0 mg, IV/Saline Lock or IO bolus, or via the Endotracheal Tube, in patients two (2) years of age or older. Use half the amount (1.0 mg) of this drug in patients less than two (2) years of age. (See Appendix J)

---

Protocol

503-A  Asystole
503-C  Brady Dysrhythmias and Complete Heart Block
511    Altered Mental Status
553    Pediatric Non-Traumatic Cardiac Arrest
556    Pediatric Altered Mental Status

---

Special Considerations

Pregnancy safety: Category B
Seizures have been reported (no causal relationship established)
May not reverse hypotension
Caution should be exercised when administering naloxone to narcotic addicts (may precipitate withdrawal with hypertension, tachycardia, and violent behavior)
NITROGLYCERINE (NITROSTAT AND OTHERS)

Class
Vasodilator

Description
It was originally believed that nitrates and nitrites dilated coronary blood vessels, thereby increasing blood flow to the heart. It is now believed that atherosclerosis limits coronary dilation and that the benefits of nitrates and nitrites result from dilation of arterioles and veins in the periphery. The resulting reduction in preload and to a lesser extent in afterload decreases the work load of the heart and lowers myocardial oxygen demand. Nitroglycerin is very lipid soluble and is thought to enter the body from the GI tract through the lymphatics rather than the portal blood.

Onset & Duration
Onset: 1-3 min.
Duration: 20-30 min.

Indications
Ischemic chest pain
Hypertension
Congestive heart failure

Contraindications
Hypersensitivity
Pericardial tamponade
Restrictive cardiomyopathy
Constrictive pericarditis
### Adverse Reactions

- Transient headache
- Postural syncope
- Reflex tachycardia
- Hypotension
- Nausea and vomiting
- Allergic reaction
- Muscle twitching
- Diaphoresis

### Drug Interactions

Other vasodilators may have additive hypotensive effects.

### How Supplied

- Tablets (sublingual): 0.15 mg (1/400 gr), 0.3 mg (1/200 gr), 0.4 mg (1/150 gr), 0.6 (1/100 gr)
- Aerosol (translingual): 0.4-mg metered dose
- Parenteral: 0.5 mg/ml, 0.8 mg/ml, 5.0 mg/ml
- Tablets (sustained release): 2.6 mg, 6.5 mg, 9 mg
- Capsules (sustained release): 6.5 mg, 9 mg
- Topical: 2% ointment

### Dosage and Administration

1/150 gr or spray 0.4 mg, sublingually, every 5 minutes, for a total of 3 doses.
Nitropaste 1 1/2 inches (if available)

### Protocol

- 504-A  Drug Therapy of Myocardial Ischemia
- 506  Acute Pulmonary Edema
Special Considerations

Pregnancy safety: Category C.
Susceptibility to hypotension in older adults increases.
Nitroglycerin decomposes when exposed to light or heat.
Must be kept in airtight containers.
Active ingredient of nitroglycerin "stings" when administered SL.
OXYTOCIN (PITOCIN)

Class
Hormone

Description
Oxytocin means "rapid birth." It is a synthetic hormone named for the natural posterior pituitary hormone. It stimulates uterine smooth muscle contractions indirectly and helps expedite the normal contractions of spontaneous labor. As in all significant uterine contractions, there is a transient reduction in uterine blood flow. 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 & Duration
Onset: (IV) Immediate

(IM) Within 3-5 min.

Duration: (IV) 20 minutes after the infusion is stopped

(IM) 30-60 min.

Indications
Postpartum hemorrhage after infant and placental delivery

Contraindications
Presence of a second fetus
Significant cephalopelvic disproportion
Unfavorable fetal positions or presentations
Adverse Reactions
Hypotension or hypertension
Tachycardia
Dysrhythmias
Angina pectoris
Anxiety
Seizure
Nausea and vomiting
Allergic reaction
Uterine rupture (from excessive administration)

Drug Interactions
Other vasopressors may potentiate hypertension.

How Supplied
10 USP units/1-ml ampule (10 U/ml) and prefilled syringe
5 USP units/1-ml ampule (5 U/ml) and prefilled syringe

Dosage and Administration
20 mU/min., IV/Saline Lock drip (if available).
Prepare the infusion by adding 20 U (2 ml) of Oxytocin to 1000 ml of Normal Saline (0.9 NS) or Ringer's Lactate (RL) (20 mU/min. = 60 ml/hr = 15 gtt/min.). If there is insufficient improvement in control of post-partum hemorrhage, the infusion rate may be increased until the desired therapeutic effects are achieved or adverse effects appear. (Maximum dosage is 40 mU/min., IV/Saline Lock drip)

Protocol
540 Obstetric Complications

Special Considerations
Pregnancy safety: Category C
Vital signs (including fetal heart rate) and uterine tone should be closely monitored
SODIUM BICARBONATE

Class
Buffer

Description
Sodium bicarbonate reacts with hydrogen ions to form water and carbon dioxide and thereby can act to buffer metabolic acidosis. Increasing the plasma concentration of bicarbonate causes blood pH to rise.

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

Indications
Known preexisting bicarbonate-responsive acidosis
Intubated patient with continued long arrest interval
Upon return of spontaneous circulation after long arrest interval
Tricyclic antidepressant overdose
Alkalinization for treatment of specific intoxications
Hyperkalemia

Contraindications
In patients with chloride loss from vomiting and GI suction
Metabolic and respiratory alkalosis
Hypocalcemia
Hypokalemia
Adverse Reactions
Metabolic alkalosis
Hypoxia
Rise in intracellular PCO₂ and increased tissue acidosis
Electrolyte imbalance (tetany)
Seizures
Tissue sloughing at injection site

Drug Interactions
May precipitate in calcium solutions.
Alkalization of urine may increase half-lives of certain drugs.
Vasopressors may be deactivated.

How Supplied
Tablets: 300 mg, 325 mg, 600 mg, 625 mg
Injection:
- 4% (2.4 mEq/5 ml)
- 4.2% (5 mEq/10 ml)
- 5% (297.5 mEq/500 ml)
- 7.5% (8.92 mEq/10 ml and 44.6 mEq/50 ml)
- 8.4% (10 mEq/10 ml and 50 mEq/50 ml)

Dosage and Administration
44-88 mEq IV/Saline Lock bolus. Repeat doses of Sodium Bicarbonate 44 mEq,

IV/Saline Lock bolus may be given every 10 minutes.

Protocol
503-A  Asystole
503-B  Ventricular Fibrillation/Pulseless Ventricular Tachycardia
503-C  Pulseless Electrical Activity
Special Considerations

Pregnancy safety: Category C.
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. May increase edematous or sodium-retaining states. May worsen congestive heart failure.
THIAMINE (BETAXIN)

Class
Vitamin (B1)

Description
Thiamine combines with ATP to form thiamine pyrophosphate coenzyme, a necessary component for carbohydrate metabolism. Most vitamins required by the body are obtained through diet, but certain states, such as alcoholism and malnutrition, may affect the intake, absorption, and use of thiamine. The brain is extremely sensitive to thiamine deficiency.

Onset & Duration
Onset: Rapid
Duration: Depends on the degree of deficiency

Indications
Coma of unknown origin (before the administration of dextrose 50%, or Naloxone)
Delirium tremens
Beriberi (rare)
Wernicke’s encephalopathy
Anemia from thiamine deficiency

Contraindications
There are no significant drug interactions with other emergency medications.

Adverse Reactions
Hypotension (from rapid injection or large dose)
Anxiety
Diaphoresis
Nausea and vomiting
Allergic reaction (usually from IV injection; very rare)
Drug Interactions

Hypersensitivity
There are no significant drug interactions with other emergency medications.

How Supplied
Tablets: 5 mg, 10 mg, 25 mg, 50 mg, 100 mg, 250 mg, 500 mg
Injection: 100 mg/ml in 10 ml vial

Dosage and Administration

100 mg, IV/Saline Lock bolus

Protocol

511 Altered Mental Status

Special Considerations

Pregnancy safety: Category A
Large IV doses may cause respiratory difficulties
Anaphylactic reactions have been reported
It should be given before D50 in a comatose patient suspected of Wernicke's encephalopathy
VASOPRESSIN

Class
Hormone (ADH)

Description
Vasopressin is a naturally occurring antidiuretic hormone. In unnaturally high doses - much higher than those needed for antidiuretic hormone effects - vasopressin acts as a non-adrenergic peripheral vasoconstrictor. Vasopressin acts by direct stimulation of smooth muscle V$_1$ receptors. This smooth muscle constriction produces a variety of effects, including pallor of the skin, nausea, intestinal cramps, desire to defecate, bronchial constriction, and in women, uterine contractions.

Onset & Duration
Onset: Instantly
Duration: 10-20 min.

Indications
Ventricular Fibrillation
Pulseless Ventricular Tachycardia

Contraindications
Hypersensitivity
Conscious patients with coronary artery disease

Adverse Reactions
Pallor
Nausea
Intestinal cramps
Bronchial constriction
Drug Interactions
None

How Supplied
Injection: 40-unit ampule IV

Dosage and Administration
40 units IV/Saline Lock Bolus, single dose, 1 time only.

Protocol
503-B Ventricular Fibrillation/Pulseless Ventricular Tachycardia

Special Considerations
Pregnancy safety: Category B.
VERAPAMIL (ISOPTIN)

Class
Calcium channel antagonist (class IV antidysrhythmic)

Description
Verapamil is used as an antidysrhythmic and antianginal 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 SA and AV nodes 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 AV conduction velocity, and prolongs the AV 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.

Onset & Duration
Onset: 2-5 min.
Duration: 30-60 min.

Indications (Only in ACLS)
PSVT
Atrial flutter with a rapid ventricular response
Atrial fibrillation with a rapid ventricular response
Contraindications

Hypersensitivity
Sick sinus syndrome (unless the patient has a functioning pacemaker)
Second- or third-degree heart block
Hypotension
Cardiogenic shock
Severe congestive heart failure
WPW with atrial fibrillation or flutter
Patients receiving intravenous beta blockers
Wide-complex tachycardias (ventricular tachycardia can deteriorate into ventricular fibrillation when calcium channel blockers are given)
Ventricular tachycardia

Adverse Reactions

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

Drug Interactions

Beta-adrenergic blockers may have additive negative inotropic and chronotropic effects.
Antihypertensives may potentiate hypotensive effects.

How Supplied

Tablet: 40 mg, 80 mg, 120 mg

Tablet (sustained release): 120 mg, 180 mg, 240 mg

Injection: 2.5 mg/ml in 2 ml, 4 ml, 5 ml vials or 2 ml, 4 ml ampules
**Dosage and Administration**

2.5-5.0 mg IV/Saline Lock bolus, *slowly*, over 2 min.; monitoring blood pressure continuously.

**Special Considerations**

Pregnancy safety: Category C.
Closely monitor patient's vital signs.
Be prepared to resuscitate.
AV block or asystole may occur as a result of slowed AV conduction.