Florida Regional Common
EMS Protocols

Section 5

Drug Section

May 31st, 2017
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5.1 Adenosine Triphosphate (Adenocard®)

**ACTIONS**
Adenosine exerts its effects by decreasing conduction through the AV mode. The half-life of Adenocard (adenosine) is less than 10 seconds. Thus its effects - both desired and undesired - are self-limited.

**INDICATIONS**
Adenocard is indicated for supraventricular tachycardia (SVT), including that associated with accessory bypass tracts (Wolff-Parkinson-White syndrome). When clinically advisable, appropriate vagal maneuvers should be attempted prior to Adenocard administration.

**CONTRAINDICATIONS**
Adenocard is contraindicated in second- or third-degree AV block and sick sinus syndrome (except in patients with a functioning artificial pacemaker), and known hypersensitivity to adenosine.

**PRECAUTIONS**
The effects of adenosine are antagonized by methylxanthines such as caffeine and theophylline. Thus larger doses may be required for adenosine to be effective in patients who have taken methylxanthines.

Adenosine effects are potentiated by dipyridamole (Persantine™). Thus smaller doses of adenosine may be effective in those who have taken this drug. Adenosine may produce bronchoconstriction in patients with asthma.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Cardiovascular: Facial flushing, headache, and rarely: sweating, palpitations, chest pain, and hypotension.
- Respiratory: Shortness of breath, chest pressure, and rarely: hyperventilating metallic taste, tightness in throat, and head pressure.
- CNS: Light headedness and rarely: dizziness, blurred vision, tingling and numbness in extremities, apprehension.

**WARNINGS**
Adenocard may produce a short-lasting first-, second-, or third-degree heart block. In extreme cases, transient asystole may result. At the time of conversion to normal sinus rhythm, a variety of new rhythms may appear (PVCs, PACs sinus bradycardia, sinus tachycardia, skipped beats, and varying degrees of AV block), though they generally last only a few seconds without intervention.

**DOSAGE**
- **Adult:** 12 mg rapid IVP immediately followed by 20 mL NS flush. If not resolved repeat in 2 minutes at 12 mg IVP, followed by 20 mL NS flush PRN.
- **Pediatric:** 0.1 mg/kg (maximum first dose 6 mg) rapid IVP/IO, immediately followed by 6 mL NS flush. If not resolved repeat in 2 minutes at 0.2 mg/kg (maximum dose 12 mg) rapid IVP, IO followed by 10 mL NS flush PRN.
5.2  Albuterol Sulfate (Proventil®, Ventolin®)

**ACTIONS**
Beat agonist relaxes bronchial smooth muscle, resulting in bronchodilation and also relaxes vascular and uterine smooth muscle, decreases airway resistance. Onset of actions between 5-15 minutes with a peak effect of 3-4 hours.

**INDICATIONS**
Indicated for relief of bronchospasm in patients with reversible obstructive airway disease, including asthma.

**CONTRAINDICATIONS**
Albuterol is contraindicated in patients with a history of hypersensitivity.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Cardiovascular: Tachycardia, hypertension, and angina.
- CNS: Nervousness, tremor, headache, dizziness, and insomnia.
- GI: Drying of oropharynx, nausea, and vomiting, unusual taste.

**WARNINGS**
Use cautiously in patients with coronary artery disease, hypertension, hyperthyroidism, and diabetes. Administer cautiously to patients on MAO inhibitors or tricyclic antidepressants. Beta blockers and albuterol will inhibit each other.

**DOSAGE**
If greater than 1 year or greater than 10 kg: Add 2.5 mg of albuterol already mixed in 3 mL of NS (0.083%) to the nebulizer and flow oxygen at 6-8 L/min

If less than 1 year or less than 10 kg: Add 1.25 mg of albuterol already mixed in 1.5 mL of NS (0.083%) to the nebulizer and flow oxygen at 3 L/min.
5.3 Amiodarone Hydrochloride (Cordarone®)

ACTIONS
Amiodarone blocks potassium channels, which contributes to slowing of conduction and prolongs cardiac cellular action potential and refractory period. Its vasodilatory action can decrease cardiac workload and consequently myocardial oxygen consumption.

INDICATIONS
Amiodarone is indicated for initiation of treatment and prophylaxis of frequently recurring ventricular fibrillation and hemodynamically unstable ventricular tachycardia in patients refractory to other therapy. It may also be used to treat supraventricular tachycardia.

CONTRAINDICATIONS
- Known hypersensitivity to amiodarone
- Cardiogenic shock,
- Sinus bradycardia,
- Second or Third Degree AV Block
- Atrial fibrillation with Wolf Parkinson White (WPW)

PRECAUTIONS
- Beta blockers, calcium channel blockers, and other antiarrhythmics are additive and can be proarrhythmic when given in combination with Amiodarone due to similar mechanisms of action.
- Amiodarone precipitates at certain concentrations when mixed at a Y-site with sodium bicarbonate, furosemide, and heparin.
- Use with caution in pregnant patients and nursing mothers. Also use with caution with patients allergic to iodine.

ADVERSE REACTIONS AND SIDE EFFECTS
Adverse reactions include fever, bradycardia, CHF, cardiac arrest, hypotension, ventricular tachycardia, nausea, and abnormal liver function.

DOSAGE
Adult: VT with pulse and SVT: 150 mg IV in 50 mL D₅W over 10 minutes. May repeat every 10 minutes PRN.
VF and pulseless VT: 300 mg IV push, if unresolved consider repeat 150 mg IVP

Pediatric: VT with a pulse and SVT: 5 mg/kg in 50 mL D₅W IV/IO over 20 minutes. VF and pulseless VT: 5 mg/kg IV/IO push.
## 5.4 Aspirin

<table>
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<th>ACTIONS</th>
<th>Aspirin is an analgesic, anti-inflammatory, and antipyretic agent, which also appears to inhibit the synthesis and release of prostaglandins. In small doses Aspirin blocks formation of thromboxane A₂ (thromboxane A₂ causes platelets to aggregate and arteries to constrict). Use of aspirin can reduce the overall mortality from acute myocardial infarction.</th>
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<td>INDICATIONS</td>
<td>Aspirin is indicated in the acute myocardial infarction (AMI) setting to prevent further clotting.</td>
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<td>CONTRAINdications</td>
<td>Known allergy to aspirin (e.g., asthma), active GI ulceration or bleeding, hemophilia or other bleeding disorders, during pregnancy, children younger than 2 years of age.</td>
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| ADVERSE REACTIONS AND SIDE EFFECTS | ● GI: Nausea, vomiting, heartburn, and stomach pain.  
● Otic: Tinnitus.  
● Hypersensitivity: Bronchospasm, tightness in chest, angioedema, urticaria, and anaphylaxis. |
| DOSAGE | Adult: 162 mg chewable (2 tablets), up to 324 PO for AMI. (High doses may interfere with the benefits of aspirin.) |
| Special Notes | Baby ASA is heat and light sensitive. The odor of acetic acid (vinegar-like smell) indicates degradation of product |
# 5.6.1 Atropine Sulfate as a Cardiac Agent

**ACTIONS**
Atropine is an anticholinergic (parasympathetic blocker, parasympatholytic) agent that reduces vagal tone, thereby increasing SA node automaticity and AV conduction.

**INDICATIONS**
- Symptomatic bradycardia (sinus, junctional, and AV blocks causing significant hypotension, ventricular ectopy, chest pain, altered level of consciousness, etc.), monitored patient only.
- In infants (< 6 months), bradycardia of less than 80 beats/min should be treated even if BP is normal.

**CONTRAINDICATIONS**
- Tachycardia
- Obstructive GI disease, paralytic ileus, intestinal atony of the elderly or debilitated patient, severe ulcerative colitis, or toxic megacolon complicating ulcerative colitis
- Hepatic disease
- Renal disease, obstructive uropathy
- Myasthenia gravis (unless used to treat side effects of acetylcholinesterase inhibitor
- Asthma
- Thyrotoxicosis
- Mobitz type II block and 3rd degree heart block

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Restlessness, agitation, confusion, psychotic reaction, pupil dilation, blurred vision, and headache.
- Cardiovascular: Increased heart rate, may worsen ischemia or increase area of infarction, ventricular fibrillation, ventricular tachycardia, angina, flushing of skin.
- GI: Dry mouth, difficulty swallowing.
- Other: Urinary retention; may worsen preexisting glaucoma.

**WARNINGS**
If a too-small dose (< 0.5 mg) is given or if atropine is pushed too slowly, it may initially cause the heart rate to decrease. Antihistamines and antidepressants potentiate the effects of atropine. A maximum dose of 0.04 mg/kg should not be exceeded. For second-degree AV block type II and third-degree AV block, omit atropine and use an external pacer instead.

**DOSAGE**
**Adult:** Bradycardia: Atropine 0.5 mg IV/IO; repeat every 3 - 5 minutes, up to a maximum total dose of 3 mg.

**Pediatric:** 0.02 mg/kg IV/IO (minimum dose = 0.1 mg; maximum single dose = 0.5 mg for a child and 1 mg for an adolescent).
5.6.2 Atropine for Antidote Poisonings

**ACTIONS** - Atropine is a potent parasympatholytic agent that binds to acetyl choline receptors, thereby diminishing the actions of acetylcholine. Atropine reverses the muscarinic effects of cholinergic poisoning by primarily reversing bronchorrhea and bronchoconstriction.

**INDICATIONS** - Anticholinesterase syndrome poisoning, such as with organophosphates (e.g., Parathion, Malathion, Rid-a-Bug) and carbamate (Baygon, Sevin, and many common roach and ant sprays). Signs of organophosphate poisoning are Salivation, Lacrimation, Urination, Defecation, GI distress, Emesis, Miosis – SLUDGEM - plus pinpoint pupils, bradycardia, and excessive sweating.

**CONTRAINDICATIONS** - None when used in the management of severe organophosphate poisoning.

**ADVERSE REACTIONS AND SIDE EFFECTS** - Victims of organophosphate poisoning require larger doses of atropine in comparison to does given with cardiac patients. Signs of atropinization are the endpoint of treatment: flushing, pupil dilation, dry mouth, and tachycardia.

**WARNINGS** - It is important that the patient be adequately oxygenated and ventilated prior to using atropine, as atropine may precipitate ventricular fibrillation in a poorly oxygenated patient. Even after atropine is administered, the patient may require intubation and aggressive ventilatory support.

**DOSAGE**

**Adult**: 0.03 mg/kg IV/IO, repeat q 5-10 minutes until atropinization occurs.  
**Pediatric**: 0.05 mg/kg (max dose 3 mg) IV/IO, repeat q 5-10 minutes until atropinization occurs.

**AtroPen**: Atropine is rapidly and well absorbed after intramuscular administration. Atropine disappears rapidly from the blood and is distributed throughout the various body tissues and fluids. Each prefilled auto-injector provides a dose of the antidote atropine in a self-contained unit, specially designed for self or caregiver administration. FOUR STRENGTHS of ATROPEN® are available; they are ATROPEN® 0.25 mg, ATROPEN® 0.5 mg, ATROPEN® 1 mg, and ATROPEN® 2 mg.

**Adults**: At least 2 to 3 mg parenterally; repeat until signs of atropine intoxication appear.  
**Peds**: AtroPen 2 mg is typically used for adults and patients weighing more than 90 lbs.

The AtroPen auto-injector should be administered as soon as symptoms of organophosphorus or carbamate poisoning appear (e.g., usually tearing, excessive oral secretions, wheezing, muscle fasciculations). More than 1 AtroPen may be required until atropinization is achieved (flushing, mydriasis, tachycardia, dryness of the mouth and nose).
5.7 Calcium Chloride 10%

**ACTIONS**
Calcium chloride increases the force of myocardial contraction; it may either increase or decrease systemic vascular resistance. In normal hearts, calcium’s positive inotropic and vasoconstricting effects produce a predictable rise in systemic arterial pressure.

**INDICATIONS**
Calcium chloride is indicated during resuscitation for the treatment of hypocalcemia and calcium-channel blocker toxicity (e.g., Verapamil or Cardizem overdose) and magnesium sulfate overdose. It also protects the heart from hyperkalemia, which may occur in patients with end-stage renal disease.

**CONTRAINDICATIONS**
Cardiopulmonary arrest not associated with calcium-channel blocker toxicity, hypocalcemia, or hyperkalemia.

**ADVERSE REACTIONS AND SIDE EFFECTS**
If the heart is beating, rapid administration of calcium can produce slowing of the cardiac rate.

**WARNINGS**
Calcium chloride should not be administered in the same infusion with sodium bicarbonate, because calcium will combine with sodium bicarbonate to form an insoluble precipitate (calcium carbonate). Calcium chloride should be given with extreme caution, and in reduced dosage, to persons taking digitalis because it increases ventricular irritability and may precipitate digitalis toxicity.

**DOSAGE**
**Adult:** For hypotension following administration of calcium-channel blockers (e.g., Cardizem, Verapamil): 4 mg/kg IV, slowly. If the patient is taking digitalis, 2 mg/kg IV, slowly. Repeat every 10 minutes PRN. For calcium-channel blocker overdose and hyperkalemia: 8-16 mg/kg IV, slowly.

**Pediatric:** 5 mg/kg or 0.2 mL/kg IV, slowly, every 10 minutes PRN. For calcium-channel blocker overdose and hyperkalemia: 20 mg/kg IV, slowly.
5.8 Calcium Gluconate

**ACTIONS**
Calcium is a basic element that is essential for growth and maintenance of nerve, muscle, and bone tissue. It is necessary for transmission of nerve impulses; contraction of cardiac, smooth, and skeletal muscles; renal function; respirations; and blood clotting. Calcium also plays an important role in the regulation of neurotransmitters, hormones, and amino acid metabolism. Its IV administration improves vascular tone and myocardial contractility in patients in hypocalcemic states. Cardiac output and blood pressure usually increase.

**INDICATIONS**
Used in the treatment of hydrofluoric acid burns and magnesium sulfate overdose. Also indicated in the management of black widow spider bites to relieve muscle spasms.

**CONTRAINDICATIONS**
- Absence of hydrofluoric acid burns or magnesium sulfate overdose
- Digitalis toxicity
- Do not mix with Sodium Bicarbonate

**ADVERSE REACTIONS AND SIDE EFFECTS**
IM administration can cause severe tissue necrosis and tissue sloughing. Calcium gluconate can also induce serious cardiac dysrhythmias.

**DOSAGE**
**Adult:** Burns to eyes: Mix Calcium Gluconate (10%) 50 mL in normal saline 500 mL and wash the eyes with the solution using a Morgan lens.

Burns to skin: Mix Calcium Gluconate (10%) 10 mL into a 2-oz tube of sterile water-based gel lubricant (KY Jelly). Apply the gel to the burned skin area.

Inhalation: Administer Calcium Gluconate (10%) 1 mL mixed with normal saline 3 mL via nebulizer. For severe exposure, administer calcium gluconate (10%) 1-2 g via slow IV over 5 minutes.
5.9  Dextrose (Glucose)

**ACTIONS**
Glucose is a monosaccharide that provides calories for metabolic needs, thereby sparing body proteins and preventing loss of electrolytes. It is readily excreted by the kidneys, producing diuresis. Dextrose is a hypertonic solution.

**INDICATIONS**
Hypoglycemia; coma of unknown origin.

**CONTRAINDICATIONS**
- Intracranial or intraspinal hemorrhage
- DTs with dehydration
- Blood glucose level > 60 mg/dL

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Cardiovascular: Thrombosis, sclerosing—if given in a peripheral vein.
- Local: Tissue irritation—if infiltration occurs.
- Other: Acidosis, alkalosis, hyperglycemia, and hypokalemia.

**WARNINGS**
May cause Wernicke-Korsakoff syndrome in acute alcohol intoxication; usually this outcome is prevented by prior administration of thiamine 100 mg IM or IV, Thiamine can be given within 24 hours to treat Wernicke-Korsakoff. Perform a glucose test prior to administering dextrose.

**DOSAGE**

**Adult:** (above 8 years of age) 50 cc of a 50% solution; (25 g) IV.

If conscious, glucose paste/gel may be given orally (15g tube).

**Pediatric:**
If conscious, and above 3 years of age glucose paste/gel may be given orally (15g tube).

If glucose less than 60 mg/dL, administer:
- If 1 month-1 year: D$_{10}$ 5 mL/kg IV/IO (b).
- If 1-8 years: D$_{25}$ 2 mL/kg IV/IO (a).
- If greater than 8 years: D$_{50}$ 1 mL/kg IV/IO (Medical Procedure 4.17, Glucometer) (a).
- If unable to obtain IV/IO access provide Glucagon IM as follows: (Medical Procedure 4.18, Medication Administration)
  - Patient less than or equal to 20 kg: 0.5 mg IM
  - Patients greater than 20 kg: 1 mg IM

  ● Repeat a glucose test with a finger stick. If glucose less than 60 mg/dL, administer dextrose dosing above.

**Newborn:** 5 mL/kg IV of a 10% solution (dilute D$_{50}$ 4:1 with NS).
5.10 Diazepam Hydrochloride (Valium®)

ACTIONS
A member of the benzodiazepine family, diazepam depresses the limbic system, thalamus, and hypothalamus, resulting in calming effects. Diazepam produces an amnesic effect and is also a muscle relaxant.

INDICATIONS
- Status epilepticus
- Premedication prior to cardioversion
- Agitation due to acute alcohol withdrawal
- Short-term relief of acute anxiety
- Cocaine intoxication
- Severe muscle spasm due to acute back strain

CONTRAINDICATIONS
- Acute alcohol intoxication
- Pregnancy (except for control of seizures associated with status epilepticus or eclampsia)
- Neonates

ADVERSE REACTIONS AND SIDE EFFECTS
- CNS: Confusion, muscular weakness, blurred vision, drowsiness, respiratory depression, respiratory arrest, slurred speech.
- Cardiovascular: Bradycardia, hypotension, and cardiovascular collapse.
- GI: Nausea, vomiting, abdominal discomfort, hiccups.
- Other: Potentiates MAOIs, barbiturates, tricyclic antidepressants, and phenothiazines; potentiated by cimetidine, ETOH, and other CNS depressants.

WARNINGS
Do not mix diazepam with any other drug, as it precipitates with almost all medications. When injecting the drug via IV, administer it slowly through the IV tubing, as close as possible to the vein insertion. Do not administer diazepam into small veins such as those on dorsum of the hand, as this causes local irritation and possibly venous thrombosis in small veins.

DOSAGE
- Adult: 5-10 mg IV/IO/IM/IN. The IV route should be administered slowly. May repeat initial dose after 2 minutes if patient still seizing. Maximum total dose 10 mg.
- Pediatric: For status epilepticus, 0.1-0.2 mg/kg (maximum dose 10 mg) IV slowly or 0.5 mg/kg (maximum dose 10 mg) PR.
5.11 Diltiazem Hydrochloride (Cardizem®)

ACTIONS
Diltiazem inhibits the influx of calcium ions during membrane depolarization of cardiac and vascular smooth muscle. The therapeutic benefits of diltiazem in supraventricular tachycardias are related to its ability to slow AV nodal conduction time and prolong AV nodal refractoriness. Diltiazem slows ventricular rates and interrupts the reentry circuit in AV nodal reentrant tachycardias and reciprocating tachycardias (e.g., Wolff-Parkinson-White syndrome). It also prolongs the sinus cycle length and decreases peripheral vascular resistance.

INDICATIONS
- Atrial fibrillation or atrial flutter with rapid ventricular response.
- Paroxysmal supraventricular tachycardia. Unless contraindicated, vagal maneuvers should be attempted prior to administration of diltiazem.

CONTRAINDICATIONS
- Sick sinus syndrome, except in the presence of a functioning ventricular pacemaker.
- Second- or third-degree AV block, except in the presence of a functioning ventricular pacemaker.
- Severe hypotension or cardiogenic shock.
- Demonstrated hypersensitivity to diltiazem.
- Intravenous diltiazem and intravenous beta blockers should not be administered together or in close proximity (within a few hours).
- Wolff-Parkinson-White syndrome or short PR syndrome.
- Ventricular tachycardia.

PRECAUTIONS
Diltiazem should be used with caution in patients with impaired liver or renal function. Intravenous diltiazem administered to a patient who is taking oral beta blockers may cause bradycardia, AV block, and/or depression of contractility. Caution should be used when administering diltiazem and anesthetics. Caution should also be used in pregnant females and mothers who are nursing. Use with caution if administered in the presence of CHF.

ADVERSE REACTIONS AND SIDE EFFECTS
Hypotension, itching or burning at the injection site, flushing of skin, or junctional rhythm. Other side effects are less frequently encountered (e.g., AV blocks, atrial flutter, chest pain).

DOSAGE
Adult: 0.25 mg/kg IV/IO every 5 minutes to a maximum does of 0.25mg/kg. If the tachyarrhythmia is not resolved in 15 minutes, may repeat Diltiazem (Cardizem) 0.35 mg/kg IV or IO (over 2 minutes).
5.12 Diphenhydramine Hydrochloride (Benadryl®)

ACTIONS
Diphenhydramine is an antihistamine with anticholinergic (drying) and sedative side effects. Antihistamines appear to compete with histamine for cell receptor sites on effector cells. Diphenhydramine prevents, but does not reverse, histamine-mediated responses—particularly histamine effects on the smooth muscle of the bronchial airways, gastrointestinal tract, uterus, and blood vessels.

INDICATIONS
- Allergy symptoms, anaphylaxis (as an adjunct to epinephrine)
- Sedation of a violent patient
- Dystonic reactions from phenothiazine overdose (e.g., Haldol, Compazine, Thorazine, and Stelazine)
- Rhinitis
- Anti-Parkinsonism syndrome
- Nighttime sedation
- Motion sickness

CONTRAINDICATIONS
Diphenhydramine is not to be used in newborn or premature infants or in nursing mothers. It is also not to be used in patients with lower respiratory tract symptoms, including asthma.

ADVERSE REACTIONS AND SIDE EFFECTS
- CNS: Drowsiness, confusion, insomnia, headache, vertigo (all especially in the elderly).
- Cardiovascular: Palpitations, tachycardia, PVCs and hypotension.
- Respiratory: Thickening of bronchial secretions, tightness of the chest, wheezing, nasal stuffiness.
- GI: Nausea, vomiting, diarrhea, dry mouth, and constipation.
- GU: Dysuria, urinary retention.

WARNINGS
- In infants and children especially, antihistamines in overdose may cause hallucinations, convulsions, or death.
- As in adults, antihistamines may diminish mental alertness in children. In young children, they may produce excitation.
- Diphenhydramine has additive effects with alcohol and other CNS depressants (e.g., hypnotics, sedatives, tranquilizers).
- Antihistamines are more likely to cause dizziness, sedation, and hypotension in elderly patients (60 years or older).

DOSAGE
**Adult:** 50 mg IV/IO, or 50 mg deep IM lateral thigh. The patient may require as much as 100 mg.

**Pediatric:** 1 mg/kg IM lateral thigh or SLOW IV (maximum dose of 50 mg). If administering Benadryl IV dilute amount in 9 mL of normal saline.
5.13 Dopamine Hydrochloride (Intropin®)

**ACTIONS**
Dopamine stimulates dopaminergic beta-adrenergic and alpha-adrenergic receptors of the sympathetic nervous system. It exerts an inotropic effect on the myocardium, resulting in an increased cardiac output. Dopamine produces less increase in myocardial oxygen consumption than does isoproterenol, and its use is rarely associated with tachyarrhythmia. Dopamine dilates renal and mesenteric blood vessels at low doses that may not increase heart rate or blood pressure. Therapeutic doses have predominant beta-adrenergic receptor-stimulating actions that result in increases in cardiac output without marked increases in pulmonary occlusive pressure. At high doses, dopamine has alpha-receptor stimulating actions that result in peripheral vasoconstriction and marked increases in pulmonary occlusive pressure.

**INDICATIONS**
To treat shock and correct hemodynamic imbalances, improve perfusion to vital organs, and increase cardiac output.

**CONTRAINDICATIONS**
Dopamine should not be used in patients with pheochromocytoma or hypovolemic shock.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Headache.
- Cardiovascular: Ectopic beats, tachycardia, anginal pain, palpitations, hypotension.
- GI: Nausea, vomiting.
- Local: Necrosis and tissue sloughing with extravasation.
- Other: Piloerection, dyspnea.

**WARNINGS**
Do not administer dopamine in the presence of uncorrected tachydysrhythmias or ventricular fibrillation. Do not add dopamine to any alkaline diluent solution, because the drug is inactivated in alkaline solution. Patients who have been treated with monoamine oxidase (MAO) inhibitors will require substantially reduced dosage. MAO inhibitors include the following agents:
- Furazolidone (Furoxone)
- Isocarboxazid (Marplan)
- Pargyline hydrochloride (Eutonyl)
- Pargyline hydrochloride with methyclothiazide (Eutron)
- Phenelzine sulfate (Nardil)
- Procarbazine hydrochloride (Matulane)
- Tranylcypromine sulfate (Parnate)

**DOSAGE**
**Adult:** Mix dopamine in D5W or Normal Saline to yield a concentration of 800 or 1600 mcg/mL. Begin the infusion at 5 mcg/kg/min and titrate to effect (maximum dose 20 mcg/kg/min).

**Pediatric:** Dopamine (1600 mcg/mL) Mix 400 mg in 250 mL of D5W, Concentration = 1600 mcg/mL, Dosage: 5-15 mcg/kg/min. Use a microdrip (60 gtt/mL) and refer to the Handtevy Medication Guide for drip rate based on patient weight or age.
5.14.1 Epinephrine 1:1,000

ACTIONS
Epinephrine is a sympathomimetic agent that stimulates both alpha- and beta-adrenergic receptors, causing immediate bronchodilation, increase in heart rate, and increase in the force of cardiac contraction.

INDICATIONS
- Asthma
- Anaphylaxis
- Angioneurotic edema

CONTRAINDICATIONS
Hyperthyroidism, hypertension, cerebral arteriosclerosis in asthma. Epinephrine should not be administered in elderly or debilitated patients with underlying cardiovascular disease. In the setting of anaphylaxis, however, there are no contraindications.

ADVERSE REACTIONS AND SIDE EFFECTS
Same as for epinephrine 1:10,000 (Drug Summary 5.14.2).

WARNINGS
Same as for epinephrine 1:10,000 (Drug Summary 5.14.2). Epinephrine 1:1000 also causes hyperglycemia. With the exception of cardiac arrest cases, Epinephrine 1:1000 should not be given intravenously; it should be diluted first (1 mg in 9 mL of NS = 1:10,000 or 1 mg/10 mL).

DOSAGE
Adult: 0.3 mg (0.3-0.5 cc) IM preferred site lateral thigh; may be repeated every 15 minutes maximum of 3 doses.

Pediatric: 0.01 mg/kg, up to 0.3 mg IM preferred site lateral thigh for asthma and anaphylaxis may be repeated every 15 minutes maximum of 3 doses.
5.14.2  Epinephrine 1:10,000

**ACTIONS**
Epinephrine is a sympathomimetic agent that stimulates both alpha- and beta-adrenergic receptors. As a result of its effects, myocardial and cerebral blood flows are increased during ventilation and chest compression. Epinephrine increases systemic vascular resistance and, therefore, may enhance defibrillation.

**INDICATIONS**
Asystole, ventricular fibrillation unresponsive to defibrillation, PEA. Other pediatric indications: hypotension in patients with circulatory instability, symptomatic bradycardia (before use of Atropine).

**CONTRAINDICATIONS**
None in the cardiac arrest situation.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Anxiety, headache, cerebral hemorrhage.
- Cardiovascular: Tachycardia, ventricular dysrhythmias, hypertension, angina, palpitations.
- GI: Nausea and vomiting.

**WARNINGS**
Epinephrine is inactivated by alkaline solutions - never mix it with sodium bicarbonate. Do not mix isoproterenol and epinephrine, as this combination results in exaggerated response. The action of catecholamines is depressed by acidosis; attention to ventilation and circulation is essential. Antidepressants potentiate the effects of epinephrine.

**DOSAGE**
**Adult:**
- IV push (1:10,000): 1 mg (10 mL) IV; repeat every 3-5 minutes.
- Pressor infusion: 1 mg/250 mL D5W; start at 1 mcg/min and titrate to effect.
- Severe anaphylaxis (ALS level 2)
  - Epinephrine (1:100,000) 0.1 mg via slow IV over 5-10 minutes,
  - Administration instructions
    - Remove 9 mL of Epi 1:10,000 from the 10 mL prefilled syringe
    - Fill the syringe back up with 9 mLs of normal saline, **You now have Epi 1:100,000 (0.01 mg/mL)**
    - Administer this solution IV (Epi 1:100,000) slowly over 10 minutes (1 mL/min), titrate to clinical effect and systolic BP greater than 90.
    - Close hemodynamic monitoring is required when providing Epinephrine 1:100,000 IV

**Pediatric:**
- IV push (1:10,000): 0.01 mg/kg (0.1 mL/kg) IV or IO; repeat every 3-5 minutes.
5.15 Fentanyl (Sublimaze)

**ACTIONS**
Fentanyl is similar to morphine and meperidine in its respiratory effects, except that respiration of healthy individuals returns to normal more quickly after fentanyl. This agent exhibits little hypnotic activity and histamine release rarely occurs. Preferentially use intranasal delivery (IN) via MAD for those where IV access may be difficult to obtain in a timely fashion (extremity burns/injuries) or not indicated for chief complaint (stable dental or back pain). After each drug dosage administration, (divide dose equally between nostrils).
- Reassess the patient’s pain
- Note adequacy of ventilation and perfusion
- Assess vital signs

**INDICATIONS**
- For relief of moderate to severe pain.
- Pain from acute myocardial infarction
- Pain associated with isolated extremity fracture, renal colic, or burns

**CONTRAINDICATIONS**
- Contraindicated if systolic blood pressure less than 90 mmHg
- Volume depletion or hypotension
- Head trauma
- Acute alcoholism
- Depressed ventilatory function (e.g., COPD, cor pulmonale, emphysema and acute asthma
- Patients with known hypersensitivity to hydromorphone.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Sedation, drowsiness, mental clouding, lethargy, impairment of mental and physical performance, anxiety, fear, dysphoria, dizziness, psychic dependence, and mood changes.
- Cardiovascular: Circulatory depression, peripheral circulatory collapse, and cardiac arrest have occurred following rapid administration.
- Orthostatic hypotension and fainting may occur if the patient stands up following injection.
- GI: Nausea and vomiting, constipation, urinary retention
- Respiratory: Respiratory depression, bronchoconstriction, decreased cough reflex

**WARNINGS**
The concomitant use of other CNS depressants—including other opioids, sedatives or hypnotics, general anesthetics, phenothiazines, tranquilizers, skeletal muscle relaxants, sedating antihistamines, potent inhibitors of P450 (e.g., erythromycin, ketoconazole, and certain protease inhibitors), and alcoholic beverages may produce increased depressant effects. Hypoventilation, hypotension, and profound sedation may occur.

**DOSAGE**
- **Monitor oxygen saturation & end-tidal CO2**
- **Adult** - 100 mcg increments every 3-5 minutes to a maximum of 200 mcg IN, IM, IO. IV dose is 1 mcg/kg (slow IV increments every 3-5 minutes, maximum initial dose of 100 mcg, titrated to pain and BP remains above 100 mm Hg). Second dose, if needed not to exceed a maximum total dose of 200 mcg IV, IN, IM, IO. If Fentanyl was initially given IN and an IV is then established, then one IV dose of 50 mcg. can be given if needed.
- **Pediatric** - 0.5 mcg/kg (maximum 25 mcg) SLOW IV; repeat once after 5 minutes as needed (max 50 mcg total dose) OR IN 1.5 mcg/kg (max 100 mcg).
5.16 Glucagon

**ACTIONS**
Glucagon, which is produced naturally in the pancreas by the alpha cells of the islets of Langerhans, causes an increase in blood glucose concentrations. It is effective in small doses, and no evidence of toxicity has been reported with its use. Glucagon acts only on liver glycogen, converting it to glucose if the patient has adequate glycogen reserves. Glucagon possesses positive inotropic and chronotropic properties.

**ONSET OF ACTION:**

<table>
<thead>
<tr>
<th>Dose</th>
<th>IM Onset</th>
<th>IV Onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mg</td>
<td>8-10 min</td>
<td>1 min</td>
</tr>
</tbody>
</table>

**Peak Effects:**

<table>
<thead>
<tr>
<th>Dose</th>
<th>IM Peak</th>
<th>IV Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mg</td>
<td>12-14 min</td>
<td>3-6 min</td>
</tr>
</tbody>
</table>

**Duration of Action:**

<table>
<thead>
<tr>
<th>Dose</th>
<th>IM Duration</th>
<th>IV Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mg</td>
<td>12-27 min</td>
<td>20 min</td>
</tr>
</tbody>
</table>

**INDICATIONS**
Documented hypoglycemia is a true medical emergency, IM glucagon should be administered rapidly if IV access is delayed. Glucagon is indicated for the treatment of hypoglycemia when an IV cannot be established and oral glucose is contraindicated. It may also be effective in symptomatic beta-blocker overdose.

**CONTRAINDICATIONS**
- Pheochromocytoma
- Insulinoma
- Known hypersensitivity
- Should not be routinely used to replace dextrose when IV access has been obtained

**ADVERSE REACTIONS AND SIDE EFFECTS**
Occasional nausea and vomiting.

**WARNINGS**
Glucagon should be administered with caution in patients with a history of insulinoma and/or pheochromocytoma.

**DOSAGE**

**Adult:** 1.0 unit (1.0 mg) of Glucagon IM. This can be repeated once in 20 minutes.

**Pediatric:**
- Patient less than or equal to 20 kg: 0.5 mg IM.
- Patient greater than 20 kg: 1 mg IM
- Not as effective in children as in adults
5.17  Haloperidol (Haldol®)

ACTIONS
Haloperidol is a potent, long-acting butyrophenone derivative. It has pharmacologic actions similar to those of piperazine phenothiazines, but is associated with higher incidence of extrapyramidal effects, less hypotension, and relatively low sedative activity. It exerts a strong antiemetic effect; it also impairs central ther moregulation. Haloperidol produces weak central anticholinergic effects and transient orthostatic hypotension. Its actions are thought to be due to blockade of dopamine activity.

INDICATIONS
Used for management of manifestations of psychotic disorders and for the treatment of agitated states in acute and chronic psychoses.

CONTRAINDICATIONS
Hypersensitivity to haloperidol, Parkinson’s disease, seizure disorders, coma, alcoholism, severe mental depression, CNS depression, thyrotoxicosis, and cocaine overdose.

ADVERSE REACTIONS AND SIDE EFFECTS
- CNS: Parkinson-like symptoms, restlessness, lethargy, headache, exacerbation of psychotic symptoms.
- Cardiovascular: Tachycardia, hypotension, hypertension (with overdose).
- GI: Nausea, vomiting.
- Other: Bronchospasm, laryngospasm, respiratory depression, dry mouth, hypersalivation (“drooling”).

WARNINGS
Use with caution in patients with severe cardiovascular disorders (may cause transient hypotension and/or precipitation of anginal pain), receiving anticonvulsant medication (may lower the convulsive threshold), or with a history of allergic reactions to drugs.

DOSAGE
Adult: 5-10 mg IM
Pediatric: 0.1mg/kg IM (maximum 5 mg).
5.18 Hydroxocobalamin (Cyanokit ®)

**ACTIONS**
The action of hydroxocobalamin in the treatment of cyanide poisoning is based on its ability to bind to cyanide ions. Each hydroxocobalamin molecule can bind one cyanide ion by substituting it for the hydroxo ligand linked to the trivalent cobalt ion, thereby forming cyanocobalamin, which is then excreted in urine.

**INDICATIONS**
Hydroxocobalamin is indicated for known or suspected cyanide poisoning. Cyanide poisoning may result from inhalation, ingestion, or dermal exposure to various cyanide-containing compounds, including smoke from closed-space fires. Sources of cyanide poisoning include hydrogen cyanide and its salts, cyanogenic plants, aliphatic nitriles, and prolonged exposure to sodium nitro-prusside.

The presence and extent of cyanide poisonings are often initially unknown. There is no widely available, rapid confirmatory cyanide blood test. Treatment decisions must be made on the basis of clinical history and signs and symptoms of cyanide intoxication. If clinical suspicion of cyanide poisoning is high, hydroxocobalamin should be administered without delay.

**Common Signs and Symptoms of Cyanide Poisoning**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>Altered mental status (e.g., confusion, disorientation)</td>
</tr>
<tr>
<td>Confusion</td>
<td>Seizures or coma</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>Mydriasis</td>
</tr>
<tr>
<td>Chest tightness</td>
<td>Tachypnea/hyperpnea (early)</td>
</tr>
<tr>
<td>Nausea</td>
<td>Bradypnea/apnea (late)</td>
</tr>
<tr>
<td></td>
<td>Hypertension (early) / hypotension (late)</td>
</tr>
<tr>
<td></td>
<td>Cardiovascular collapse</td>
</tr>
<tr>
<td></td>
<td>Vomiting</td>
</tr>
<tr>
<td></td>
<td>Plasma lactate concentration ≥ 8 mmol/L</td>
</tr>
</tbody>
</table>

**CONTRAINDICATIONS** None.

**ADVERSE REACTIONS AND SIDE EFFECTS**
Serious adverse reactions include allergic reactions and increased blood pressure. Other side effects include:
- Red-colored urine
- Red-colored skin and mucous membranes, acne-like rash
- Nausea, vomiting, diarrhea, bloody stools, trouble swallowing, stomach pain
- Throat tightness, dry throat
- Headache, dizziness, memory problems, restlessness
- Infusion site reaction
- Eye swelling, irritation, or redness
- Swelling of feet and ankles
- Irregular heartbeat, increased heart rate
- Fluid in lungs
5.18 Hydroxocobalamin (Cyanokit ®) continued

**WARNINGS**
In addition to hydroxocobalamin, treatment of cyanide poisoning must include immediate attention to airway patency, adequacy of oxygenation and hydration, cardiovascular support, and management of any seizure activity. Consideration should be given to decontamination measures based on the route of exposure.
Many patients with cyanide poisoning will be hypotensive; however, elevations in blood pressure have also been observed in known or suspected cyanide poisoning victims.

**DOSAGE**
**Adult:** 5 g packaged as a single 5 g vial or in two 2.5 g vials administered as an IV infusion over 15 minutes (approximately 15 mL/min)—if using the two vials 7.5 minutes per vial. Depending on the severity of the poisoning and the clinical response, a second dose of 5 g may be administered by IV infusion for a total dose of 10 g. The rate of infusion for the second dose may range from 15 minutes (for patients in extremis) to 2 hours, as clinically indicated.

**Pediatric:** 70 mg/kg 10 gtt/min over 15 minutes has been used to treat pediatric patients.
5.19 **Ipratropium Bromide (Atrovent®)**

**ACTIONS**
Ipratropium bromide is an anticholinergic (parasympatholytic) agent, which causes localized bronchodilation.

**INDICATIONS**
Ipratropium bromide is indicated for relief of bronchospasms associated with asthma and chronic obstructive pulmonary disease, including chronic bronchitis and emphysema that is unresponsive to treatment with albuterol alone.

**CONTRAINDICATIONS**
Hypersensitivity to atropine or its derivatives.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- **Respiratory:** Cough, exacerbation of symptoms.
- **CNS:** Nervousness, dizziness, headache.
- **Cardiovascular:** Palpitations.
- **GI:** Nausea, vomiting, GI distress.
- **Other:** Tremor, dry mouth, blurred vision.

**WARNINGS**
Ipratropium bromide is not indicated for the initial treatment of acute episodes of bronchospasms where rapid response is required.

**DOSAGE**
**Adult:** Add 0.5 mg (0.5 mL) of Atrovent to the nebulizer (in addition to the standard dose of albuterol) and flow oxygen at 6-8 L/min.

**Pediatric:** Add Ipratropium Bromide (Atrovent®) to Albuterol nebulizer treatment and flow oxygen at 6-8 L/min
- If patient less than 8 year, 0.25mg/1.25mL
- If patient greater than 8 year, 0.5mg/2.5mL
5.20  Ketamine Hydrochloride

**ACTIONS** Nonbarbiturate anesthetic

**INDICATIONS**
- Violent Agitated Patient
- Failure to “talk patient down”
- Suspected “Excited Delirium” (confusion, agitation, drug abuse)
- Resisting restraints putting self or crew in danger

**CONTRAINDICATIONS**
- Significant Head Trauma
- Increased intracranial pressure

**WARNINGS/PRECAUTIONS**
Respiratory depression/apnea may occur with overdosage or too rapid rate of use; employ supportive ventilation and respiration. Caution with chronic alcoholics and acutely alcohol-intoxicated and in elderly patients. Use in pregnancy is not recommended.

**ADVERSE REACTIONS**
- Hypertension and tachycardia, generally self-limited
- Laryngospasm: may produce mild stridor, oxygen and BVM prn
- Hypersalivation – can cause an increase in oral secretions, elevating the head 30 degrees may help.
- Nausea and vomiting
- Tonic and clonic muscle movements
- Transient respiratory depression occasionally occurs
- Roving eye movements and nystagmus

**PSYCHOLOGICAL ADVERSE REACTIONS**
- Visual Hallucinations
- Emergence Delirium
- Sensation of detachment from the body

**ADULT DOSAGE**

**Excited Delirium**
- 4 mg/kg IM to the lateral thigh or deltoid or 2 mg/kg IN (max dose 400 mg)
- Use 100 mg/mL concentration

**Pain**
- 20 mg IV SLOW over 1 minute.
  - May be repeated once within 5-10 minutes if desired effect is not met.
- **Note**: Must dilute if using 100 mg/mL concentration. May repeat x 1 in 5 minutes.
  - Dilution instructions - Add 20 mg (0.2 mL of 100 mg/mL concentration) to 0.8 mL Normal Saline. Then administer slowly over 1 minute.
5.21 Lorazepam (Ativan®)

ACTIONS
Lorazepam is a benzodiazepine, so it depresses the central nervous system. It produces sedation, relieves anxiety, causes lack of recall, and provides for relief of skeletal muscle spasms.

INDICATIONS
• Adjunct to seizure control
• Control of violent patients

CONTRAINDICATIONS
Known sensitivity to benzodiazepines; narrow-angle glaucoma.

PRECAUTIONS
May cause respiratory depression.

ADVERSE REACTIONS AND SIDE EFFECTS
• CNS: Excessive CNS depression.
• Cardiovascular: Rarely hypotension/hypertension.
• Respiratory: Hypoventilation, partial airway obstruction.
• Local: Pain, burning, and redness at injection site.
• General: Nausea/vomiting and skin rash.

DOSAGE
Adult: 1-2 mg IV, IO, IM or IN may be repeated once as needed, up to maximum of 4 mg.

Pediatric: 0.1mg/kg IV, IO, IM or IN, maximum single dose 2 mg, if no effect after 5 minutes may be repeated once to maximum of 4 mg.
5.22 Magnesium Sulfate

**ACTIONS**
Magnesium is an important cofactor for enzymatic reactions and plays an important role in neurochemical transmission and muscular excitability. Magnesium prevents or controls convulsions by blocking neuromuscular transmission and decreasing the amount of acetylcholine liberated at the end-plate by the motor nerve impulse. It is said to have a depressant effect on the central nervous system, but it does not affect the mother, fetus, or neonate when used as directed in eclampsia and pre-eclampsia. Magnesium acts peripherally to produce vasodilatation.

**INDICATIONS**
- Parenteral anticonvulsant for the prevention and control of seizures in severe toxemia of pregnancy, pre-eclampsia and or eclampsia.
- Torsades de pointes.
- Severe asthma
- Suspected hypomagnesemic state (e.g., chronic alcoholism and chronic use of diuretics).
- Refractory ventricular fibrillation.

**PRECAUTIONS** - Because magnesium is removed from the body solely by the kidneys, this drug should be used with caution in patients with renal impairment. Monitoring magnesium serum levels and the patient’s clinical status is essential to avoid the consequences of overdose and toxemia. Clinical indications that it is safe to give magnesium to the patient include the presence of a patellar reflex (knee jerk) and the absence of respiratory depression (approximately 16 breaths or more per minute). Calcium chloride should be immediately available to counteract the potential hazards of magnesium intoxication in eclampsia.

**ADVERSE REACTIONS AND SIDE EFFECTS** - Adverse effects of magnesium sulfate IV are usually the result of magnesium intoxication. Signs of hypermagnesemia include flushing, sweating, hypotension, depression of reflexes, flaccid paralysis, hypothermia, circulatory collapse, depression of cardiac function, and central nervous system depression. These symptoms can precede fatal paralysis.

**WARNINGS** - Magnesium sulfate should not be given intravenously to mothers with toxemia of pregnancy during the 2 hours immediately preceding delivery. Magnesium sulfate injection USP, 50%, must be diluted to a concentration of 20% or less prior to IV infusion.

**ADULT:**
- **Severe asthma** – 2 g IV (mixed in 50 mL or 100 mL of D5W) given over 5-10 minutes. Monitor the blood pressure and if it decreases slow down or stop the infusion.
- **Eclamptic seizures** - 4 gm IV (mixed in 50 mL of D5W and administered over 5-10 minutes). May repeat once at 2 g IV (mixed in 50 mL of D5W and administered over 5-10 minutes).
- **Torsades de pointes and refractory VF:** 1-2 g IV (mixed in 50 mL or 100 ml of D5W and administered over 1-2 minutes), followed by a maintenance infusion (1 g in 250 mL of D5W administered at 30-60 gtts/min).

**PEDIATRIC:**
- **Severe asthma** – 40 mg/kg (max 2 g) IV mixed in 50 mL D5W given over 30 minutes. Monitor the blood pressure and if it decreases slow down or stop the infusion
- **Torsades de pointes (without a pulse) and refractory VF:** 25-50 mg/kg IV/IO, up to a maximum dose of 2 g over 2 minutes, followed by a maintenance infusion (1g in 250 mL of D5W at 30-60 gtts/min).
ACTIONS
Low concentrations of methylene blue will convert methemoglobin to hemoglobin (methemoglobin is toxic and gives the blood a chocolate-brown color; it does not carry oxygen). High concentrations convert ferrous iron of hemoglobin to ferric iron, thereby forming methemoglobin.

INDICATIONS
Initial treatment of methemoglobinemia.

CONTRAINDICATIONS
Renal insufficiency (excreted in urine and bile).

ADVERSE REACTIONS AND SIDE EFFECTS
Cyanosis, profuse sweating, dizziness, headache, nausea, vomiting, diarrhea (turns urine and stool blue-green). May induce hemolysis in patients deficient in glucose-6-phosphate dehydrogenase.

DOSAGE Methylene blue (10 mg/mL)
Adult: 1 mg/kg of a 1% solution. Very slow IV push of 1 mL (10 mg) every 5 minutes.
Pediatric: 1 mg/kg IV over 5 minutes, See Handtevy Medication Guide (WMD page) for dosing
5.24 Methylprednisolone Sodium Succinate (Solu-Medrol®)

**ACTIONS**
Methylprednisolone sodium succinate is a potent anti-inflammatory synthetic steroid.

**INDICATIONS**
Control of severe allergic reactions, asthmatic attacks, and bronchospasm associated with COPD that do not respond to other treatments.

**CONTRAINDICATIONS**
Known hypersensitivity, neonates, and patients with systemic fungal infections.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Cardiovascular: Fluid retention, hypertension/hypotension, dysrhythmias, CHF, electrolyte imbalance.
- CNS: Seizures, vertigo, headache.
- GI: Nausea/vomiting, GI bleeding, abdominal distention.
- General: Urticaria, anaphylactic reaction.

**DOSAGE**
**Adult:** Bronchospasm associated with asthma, COPD, severe allergic reactions, or adrenal crisis: 125 mg IV. If IV cannot be established then administer IM 125 mg.

**Pediatric:** Bronchospasm associated with asthma, severe allergic reaction, or adrenal crisis: 2 mg/kg IV (maximum dose 60 mg). If IV cannot be established then administer 2 mg/kg IM (maximum dose 60 mg).
5.25 Midazolam (Versed®)

**ACTIONS**
Midazolam is a short-acting benzodiazepine (a central nervous system depressant) that produces sedation and lack of recall.

**INDICATIONS**
- Status epilepticus
- Premedication prior to cardioversion
- Agitation due to acute alcohol withdrawal
- Short-term relief of acute anxiety
- Cocaine intoxication
- Severe muscle spasm due to acute back strain

**CONTRAINDICATIONS**
- Acute alcohol intoxication
- Pregnancy (except for control of seizures associated with status epilepticus or eclampsia)
- Neonates

**PRECAUTIONS**
Midazolam does not protect against the increase in intracranial pressure and bradycardia associated with multiple intubation attempts.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Respiratory: Respiratory depression, laryngospasm, bronchospasm, dyspnea.
- Cardiovascular: PVCs, bradycardia, tachycardia, nodal rhythms, hypotension.
- CNS: Retrograde amnesia, altered mental status, dizziness, prolonged emergence from anesthesia.
- GI: Nausea/vomiting, hiccoughs, coughing.
- Local: Pain, redness, swelling, burning at injection site.

**DOSAGE**
**Adult:** Sedation and seizures:
Sedation and seizures: 5 mg IV, IO, IM, or IN. Maximum total dose of 10 mg.

**Pediatric:** 0.1mg/kg, maximum single dose 4 mg IV, IO, IM. For IN administration use 0.2 mg/kg/dose (use 10 mg/2mL concentration), maximum single dose 5 mg; may repeat once if necessary. Maximum total dose of 10 mg.

For IN administration, administer 1ml per nare, give half the volume in one nostril and the other half of the volume in the other nare.
5.26  Morphine Sulfate (MS)

**ACTIONS**
Morphine is a narcotic analgesic. It depresses the central nervous system and decreases sensitivity to pain. It increases venous capacitance, decreases venous return, and produces mild peripheral vasodilatation. Morphine also decreases myocardial oxygen demand.

**INDICATIONS**
- Pain from acute myocardial infarction
- Pain associated with isolated extremity fracture, isolated acute back strain, renal colic, or burns
- Abdominal pain or with flank pain that is associated with kidney stones.
- SOFT-TISSUE INJURIES, BURNS, BITES, AND STINGS
- Pain associated with multisystem trauma, soft-tissue injuries, burns, bites, and stings

**CONTRAINDICATIONS**
- Volume depletion or hypotension
- Head trauma (relative)
- Acute alcoholism
- Acute asthma
- Known hypersensitivity to MS

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Euphoria, drowsiness, pupillary constriction, respiratory arrest.
- Cardiovascular: Bradycardia, hypotension.
- GI: Decreased gastric motility, nausea and vomiting.
- GU: Urinary retention.
- Respiratory: Bronchoconstriction, decreased cough reflex
- Watch for histamine effects (wheals, urticaria) proximal to IV site; contact medical control

**WARNINGS**
Morphine is detoxified by the liver. It is potentiated by alcohol, antihistamines, barbiturates, sedatives, and beta blockers.

**DOSAGE**
**Adult:** 5 mg-SLOW IV may repeat once in 5 - 10 minutes until desired response is achieved (maximum dose 10 mg). Can also be given IM. Peak effects occur within 20 minutes.

**Pediatric:** 0.1-0.2 mg/kg IV slowly Administer at a rate not to exceed 1 mg/min. If pain persists and systolic BP is adequate, may repeat dose x 1 in 3-5 minutes, (repeat single dose maximum of 4 mg).

**Infant:** 0.05 mg/kg IV slowly
5.27 Naloxone Hydrochloride (Narcan®)

**ACTIONS**
The mechanism of action for naloxone hydrochloride is not fully understood. It does appear that this agent antagonizes the effects of opiates by competing at the same receptor sites. When given IV, the action is apparent within 2 minutes. Effects appear slightly more slowly with IM.

**INDICATIONS**
Naloxone is indicated for the complete or partial reversal of opiate narcotic depression and respiratory depression secondary to opiate narcotics or related drugs: Naloxone can also be used for suspected acute opiate OD.

<table>
<thead>
<tr>
<th>Codeine</th>
<th>Methadone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>Morphine</td>
</tr>
<tr>
<td>Heroin</td>
<td>Pentazocine (Talwin)</td>
</tr>
<tr>
<td>Hydromorphone (Dialaudid)</td>
<td>Percodan</td>
</tr>
<tr>
<td>Lomotil</td>
<td>Propoxyphene (Darvon)</td>
</tr>
<tr>
<td>Meperidine (Demerol)</td>
<td></td>
</tr>
</tbody>
</table>

**CONTRAINDICATIONS**
Naloxone is contraindicated in patients known to be hypersensitive to it. Nebulized Narcan with EtCO2 greater than 45 and SpO2 less than 94% or inadequate ventilatory effort.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Tremor, agitation, belligerence, pupillary dilation, seizures, increased tear production, sweating, seizures secondary to withdrawal.
- Cardiovascular: Hypertension, hypotension, ventricular tachycardia, pulmonary edema, ventricular fibrillation.
- GI: Nausea, vomiting

**WARNINGS**
Naloxone should be administered cautiously to persons (including newborns of mothers) who are known or suspected to be physically dependent on opiates; it may precipitate an acute abstinence syndrome in these individuals. Naloxone administration may need to be repeated in this scenario because the duration of action of some narcotics may exceed that of naloxone. Naloxone is not effective against a respiratory depression caused by non-opiate drugs. Use caution during its administration because patients may become violent as their level of consciousness increases.

**DOSAGE**
**Adult:**
- Administer Naloxone (Narcan) 0.4 mg – 2 mg IV/IO/IM or IN to restore adequate ventilatory effort and/or improve mental status and-titrate to effect. Usual doses should not exceed 10 mg, Fentanyl may require large doses of Naloxone to reverse Fentanyl’s effects.
- If administering Naloxone (Narcan) via IN, must use concentration 2 mg/2 mL (For IN administration refer to 4.18.5)
- If administering Naloxone (Narcan) via nebulization must use concentration 2 mg/2 mL (add 2 mg of Narcan to 3 mL of saline) and titrate to effect. If administering Naloxone (Narcan) via prepackaged product Nasal Spray then the dose is 4 mg/0.1 mL spray IN

**Pediatric:** 0.1 mg/kg IV, IM, IO, IN may repeat with 0.1 mg/kg if no improvement is noted.
Nitroglycerin (Nitrostat®, Nitrolingual® Spray)

ACTIONS
Nitroglycerin is a direct vasodilator that acts principally on the venous system, although it also produces direct coronary artery vasodilation. Its use decreases venous return, which in turn decreases the workload on the heart, and thereby decreases myocardial oxygen demand. Sublingual nitroglycerin is readily absorbed. Pain relief occurs within 1-2 minutes and therapeutic effects can last as long as 30 minutes.

INDICATIONS
- Chest pain or discomfort associated with suspected AMI or angina pectoris
- Pulmonary edema with hypertension

CONTRAINDICATIONS
Patients with increased intracranial pressure, systolic blood pressure less than 90 mm Hg, children younger than 12 years.

PRECAUTIONS
Tolerance to nitrates easily develops, which necessitates increasing the dosage. Nitroglycerin tablets are inactivated by light, heat, air, and moisture, so they must be kept in amber glass containers with tight-fitting lids. Do not leave cotton in the container. Do not shake Nitrolingual spray. Alcohol will accentuate the vasodilating and hypotensive effects of nitroglycerin. The patient has taken any of the following erectile dysfunction medications. (Note the following medications are also marketed under a variety of other trade names).
- a. Stendra (Avanafil) – in the past 12 hours
- b. Viagra (Sildenafil) – in the past 24 hours
- c. Levitra (Vardenafil) or Cialis (Tadalafil) – in the last 48 hours

ADVERSE REACTIONS AND SIDE EFFECTS
- CNS: Headache, dizziness, flushing, nausea and vomiting.
- Cardiovascular: Hypotension, reflex tachycardia.

DOSAGE
Adult: 0.4 mg (1 tablet or 1 spray sublingual); may repeat in 3-5 minutes (maximum dose of 1.2 mg or 3 doses).
5.29 Nitrous Oxide 50% Blended in Oxygen (Nitronox®)

**ACTIONS**
Nitrous oxide is a colorless gas that acts on the central nervous system. When mixed with 50% oxygen and inhaled, it produces an effect similar to a mild intoxicant. The patient laughs and talks but does not go to sleep. When inhaled, nitrous oxide has potent analgesic effects, which dissipate within 2-5 minutes after stopping its administration.

**INDICATIONS**
Moderate to severe pain, as in trauma, burns, renal colic, and labor.

**CONTRAINDICATIONS**
Nitrous oxide is contraindicated in any altered state of consciousness (e.g., head injury, alcohol ingestion, drug overdose). It is also contraindicated in patients with COPD, acute pulmonary edema, pneumothorax, decompression sickness, air embolus, abdominal pain with distention or suspicion of obstruction, and pregnancy (except during delivery), and in patients who are unable to self-administer Nitronox.

**ADVERSE REACTIONS AND SIDE EFFECTS**
Light-headedness, confusion, drowsiness, nausea and vomiting.

**WARNINGS**
Because nitrous oxide is heavier than air, it may accumulate on floor of ambulance. During transits lasting more than 15 minutes, nitrous oxide may affect ambulance personnel.

**DOSAGE**
Blended mixture of 50% nitrous oxide and 50% oxygen, which is self administered through inhalation. Also apply O₂ cannula at 4-6 L to maintain O₂ therapy when nitrous oxide is not being administered.

Note: Also see Medical Procedure 4.21, Nitrous Oxide-Nitronox
5.30 Pralidoxime (2-PAM®, Protopam Chloride®)

**ACTIONS**
Pralidoxime reactivates cholinesterase that has been deactivated by organophosphorous pesticides and related products. It inactivates acetylcholine at both muscarinic and nicotinic sites in the periphery.

**INDICATIONS**
Organophosphorous toxicity; used as an adjunct to systemic atropine administration.

**CONTRAINDICATIONS**
- Poisoning with Sevin (a carbamate insecticide); Sevin increases the drug’s toxicity.
- Use with extreme caution in patients with a history of asthma, renal insufficiency, and peptic ulcers.

**ADVERSE REACTIONS AND SIDE EFFECTS**
- CNS: Dizziness, headache, drowsiness, excitement.
- Cardiovascular: Tachycardia.
- EENT: Blurred vision, diplopia, impaired accommodation, laryngospasm.
- GI: Nausea.
- Other: Muscular weakness or rigidity, hyperventilation.
- Rapid injection of 2-PAM can cause tachycardia, laryngeal spasm, muscle rigidity, and transient neuromuscular blockage.

**DOSAGE**
Pralidoxime (2-PAM) (1 g dry powder: Mix with 20 cc sterile water (50 mg/mL).

**Adult:** IV infusion 1-2 g in 100 mL of saline over 30 minutes.
If pulmonary edema is present, give IVP over 5 minutes.

**Pediatric:** 25 mg/kg IV See Handtevy Medication Guide (WMD page) for dosing, Dilute recommended dose with NS and infuse over 10 minutes, then can provided continuous infusion at 5-10 mg/kg/hr.
5.31 Sodium Bicarbonate 8.4% and 4.2%

**ACTIONS**
This alkalizing agent is used to buffer acids present in the body during and after severe hypoxia. Bicarbonate combines with excess acids (usually lactic acid) present in the body to form a weak, volatile acid. This acid is broken down into CO₂ and H₂O. Sodium bicarbonate is effective only when administered in patients who have adequate ventilation and oxygenation.

**INDICATIONS**
Metabolic acidosis due to the following causes:
- Salicylate (aspirin) overdose
- Barbiturate overdose
- Tricyclic antidepressant overdose
- Hyperkalemia
- Severe ketoacidosis
- Cardiac arrest
- Shock
- Physostigmine toxicity
- Methanol toxicity
- Ethylene glycol toxicity

**CONTRAINdications**
Congestive heart failure; alkalotic states.

**ADVERSE REACTIONS AND SIDE EFFECTS**
Metabolic alkalosis; hypernatremia; cerebral acidosis; sodium and H₂O retention, which can cause CHF.

**WARNINGS**
Excessive bicarbonate therapy inhibits the release of oxygen. Bicarbonate does not improve the ability to defibrillate. Administration of sodium bicarbonate may inactivate simultaneously administered catecholamines; it will create an insoluble precipitate if mixed with calcium chloride. Administration should be guided by arterial blood gases and pH data, when available.

**DOSAGE**
**Adult:** 1 mEq/kg IV (8.4%). Repeat with 0.5 mEq/kg q 10 minutes.

**Pediatric:** 1 mEq/kg IV (8.4%). Repeat with 0.5 mEq/kg q 10 minutes.

**Infant:** 1 mEq/kg IV (4.2%) slowly; may repeat in 10 minutes.
**5.32 Sodium Thiosulfate**

**ACTIONS**
Sodium thiosulfate converts cyanide to the less toxic thiocyanate. The thiocyanate is then excreted in the urine.

**INDICATIONS**
Used in acute cyanide toxicity; not useful in hydrogen sulfide toxicity.

**CONTRAINDICATIONS**
None in acute cyanide toxicity.

**DOSAGE**
Sodium Thiosulfate (25%)
- **Adult**: 12.5 g (50 mL of 25% solution) given by slow IV over 10 minutes.
- **Pediatric**: 1.2 mL/kg IV over 10-20 minutes, See Handtevy Medication Guide (WMD page) for dosing
5.33 Succinylcholine Chloride (Anectine®)

**ACTIONS**
Succinylcholine chloride is a short-acting skeletal muscle paralytic. Onset of action occurs in 1-2 minutes, with recovery happening in 5-10 minutes. This agent works by depolarizing the receptors on skeletal muscle. It then blocks the action of acetylcholine, which causes enhanced cholinergic activity, with the face and neck muscles being affected first. These effects are followed by paralysis of the chest, diaphragm, and other skeletal muscles. Use of succinylcholine may trigger histamine release.

**INDICATIONS**
Facilitation of endotracheal intubation.

**CONTRAINDICATIONS**
- Known sensitivity to succinylcholine or other anesthetics
- Preexisting neuromuscular disease (myasthenia gravis)
- Organophosphate or anticholinesterase toxicity
- Severe burns or eye injuries
- Tetanus

**ADVERSE REACTIONS AND SIDE EFFECTS**
- Prolonged respiratory depression
- Bradycardia (rare tachycardia or hypertension)
- Hypersalivation and bronchospasm

**DOSAGE**
Succinylcholine (20mg/mL)
**Adult:** 1 mg/kg IV over 30-60 seconds
**Pediatric:**
- 1 year and below: 2 mg/kg IV/IM
- 2 years and above: 1 mg/kg IV/IM
5.34 Tetracaine Hydrochloride 0.5% Eye Drops

**ACTIONS**
Tetracaine is an ophthalmic solution that anesthetizes the eyes. The onset of anesthesia usually begins within 20 seconds and lasts as long as 15 minutes.

**INDICATIONS**
Tetracaine is intended for use in the patient who is unable to cooperate with the provider in adequately flushing the eye(s) due to discomfort or pain. If flushing can be accomplished easily, tetracaine may not be needed.

**CONTRAINDICATIONS**
Allergy to any topical anesthetic.

**PRECAUTIONS**
Do not use the solution if it contains crystals, or if it is cloudy or discolored. Tetracaine eye drops are for topical ophthalmic use only - not for injection. The patient should be advised not to touch or rub the eye(s) until the effect of the anesthesia has worn off.

**DOSAGE Adult and Pediatric**
1 drop in each affected eye.
Vecuronium bromide is a short-acting, nondepolarizing skeletal muscle relaxant. Its binding with cholinergic receptor sites inhibits transmission of nerve impulses, antagonizing the action of acetylcholine. Vecuronium bromide has no analgesic properties, and the patient may be conscious but unable to communicate by any means. The first muscles affected are those of the eyes, face, and neck, followed by the limbs, abdomen, and chest; the diaphragm is affected last. Recovery usually occurs in the reverse order and may take longer than 60 minutes. With IV administration, the onset of action is in 30-60 seconds; peak action occurs in 3-5 minutes and the effects last for 30-60 minutes.

**INDICATIONS**
An authorized paramedic may induce general anesthesia to facilitate intubation.

**PRECAUTIONS**
Vecuronium bromide causes respiratory paralysis—supportive airway control must be continuous and under direct observation at all times. Myasthenia gravis and other neuromuscular diseases increase sensitivity to the drug.

**ADVERSE REACTIONS AND SIDE EFFECTS**
Hypersensitivity reactions are possible.

**DOSAGE**
**Adult and Pediatric** (over 10 years): 0.08 - 0.1 mg/kg; slow administration over 30-60 seconds IV. Dose is usually 5-7 mg for an average-size adult.

**Pediatric** (1-9 years of age): May require a higher dose.
5.36 Ondansetron hydrochloride (Zofran®)

**ACTIONS**
Ondansetron hydrochloride (Zofran) blocks serotonin receptors (5HT3) found in the neurons of the gastrointestinal system and in the area of the brain that controls nausea and vomiting.

**INDICATIONS**
Nausea and vomiting

**PRECAUTIONS**
Ondansetron can be associated with a prolongation of the QT interval. Therefore, do not use Ondansetron in patients with a known long QT interval or who are taking medications that are known to prolong the QT interval. Arrhythmias believed to be caused by prolongation of the QT interval should be treated immediately with IV Magnesium Sulfate (Protocol 2.3.6). Zofran ODT contains Phenylalanine which is aspartame artificial sweetener found in Equal. May cause an allergic reaction to patients allergic to aspartame.

**ADVERSE REACTIONS AND SIDE EFFECTS**
Hypersensitivity reactions are possible.
Common side effects of Ondansetron include abdominal pain, anxiety, diarrhea, fever, dizziness, drowsiness, constipation and headache.
Uncommon side effects of Ondansetron include chest pain, decrease in blood pressure, itch, rash, tremor and uncontrolled muscle movements.

**DOSAGE**

**Adult**
**Oral** 4 mg PO disintegrating tablet (ODT) placed under the tongue. May repeat at 10-15 minutes with maximum dose of 8 mg

**Injection** 4 mg slow IV push over 2-3 minutes OR IM lateral thigh. May be repeated once if no improvement within 10-15 minutes. Do not exceed 8 mg total dosage

**Pediatric**
**Oral**
Less than 20 kg: Do NOT administer

20 kg - 39 kg (5-11 year): 4 mg oral disintegrating tablet (ODT) placed under the tongue. Dose may not be repeated

40 kg or more (12 year or older): 4 mg oral disintegrating tablet (ODT) placed under the tongue. May repeat at 10-15 minutes with maximum dose of 8 mg

**Injection**
Less than 40 kg: 0.1 mg/kg SLOW IV over 2-3 minutes or IM (preferably in the lateral thigh). Do not repeat.

40 kg or more: 4 mg. SLOW IV push over 2-3 minutes or IM (preferably in the lateral thigh) May be repeated once if no improvement within 30 minutes. Do not exceed 8 mg total dosage.