

EMS personnel must be familiar with a number of drugs and other agents in their routine work. What follows is a description of drugs or agents used by EMS personnel. EMS personnel should use the generic names when referring to any drug or agent. The trade name(s) are given in parentheses. While indication, contraindication, drug doses, and other relevant information are included in this formulary for information purposes, EMS personnel should refer to specific treatment protocols regarding use of any of these drugs or agents.

Drugs are categorized according to their level of risk to the fetus. The categories are interpreted as follows:

- **Category A:** controlled studies fail to demonstrate a risk to the fetus in the first trimester, and there is no evidence of risk in later trimesters; the possibility of fetal harm appears to be remote.
- **Category B:** either animal reproductive studies have not demonstrated a fetal risk but there are no controlled studies in women or animal reproductive studies have shown an adverse effect that was not confirmed in controlled studies on women in the first trimester and there is no evidence of risk in later trimesters.
- **Category C:** either studies in animals have revealed adverse effects on the fetus and there are no controlled studies in women or studies in women and animals are not available. Drugs in this category should be given only if the potential benefit justifies the risk to the fetus.
- **Category D:** there is positive evidence of human fetal risk, but the benefits for pregnant women may be acceptable despite the risk, as in life-threatening diseases for which safer drugs cannot be used or are ineffective.
- **Category X:** studies in animals and humans have demonstrated fetal abnormalities, there is evidence of fetal risk based on human experience, or both; the risk of using the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant.

Drugs included in this formulary include:

- acetaminophen
- acetylsalicylic acid
- amiodarone
- atropine
- dextrose (D50W)
- diazepam
- dimenhydrinate
- diphenhydramine
- epinephrine
- furosemide
- glucagon
- glucose
- heparin sodium
- lidocaine
- lorazepam
- midazolam
- morphine
- naloxone
- nitroglycerine
- nitrous oxide – oxygen 50:50 mixture
- oxygen
- oxytocin
- salbutamol

APPENDIX: Drug Formulary

ACETAMINOPHEN (TYLENOL)

Class

- Analgesic, antipyretic

Mechanism of Action

- Analgesia: not clearly defined
- Antipyresis: inhibition of the effect of endogenous pyrogens on CNS heat-regulating centers

Indications

- mild to moderate pain
- fever

Contraindications

- hypersensitivity to acetaminophen

Adverse Reactions

- no significant adverse reactions noted at therapeutic doses

Drug Interactions

- no significant drug interactions from a single therapeutic dose

How Supplied

- liquid: 80 mg/ml (drops), 160 mg/5ml (syrup)
- tablets: 325 mg/tab, 500 mg/tab

Dosage and Administration

- given as a single oral dose
- Age-based:
 - 4 – 11 months: 80 mg
 - 12 – 23 months: 120 mg
 - 2 – 3 years: 160 mg
 - 4 – 5 years: 240 mg
 - 6 – 8 years: 320 mg
 - 9 – 10 years: 400 mg
 - 11 – 12 years: 480 mg
 - >12 years: 650 mg
- If weight known:
 - 15 mg/kg, Maximum 1000mg (may round off to nearest 10 mg)

Duration of Action

- onset: 30 minutes
- peak effect: variable
- duration: 4 hours

Special Considerations

- pregnancy safety: Over 40 years of clinical experience, available data indicate that acetaminophen in therapeutic doses does not adversely affect the pregnant mother or the fetus.

APPENDIX: Drug Formulary

ACETYLSALICYLIC ACID (ASPIRIN, ASA)

Class

- platelet inhibitor, anti-inflammatory agent

Mechanism of Action

- prostaglandin inhibition, prevents platelet aggregation

Indications

- chest pain suggestive of acute MI
- patient with previous cardiac history presenting with chest pain consistent with cardiac ischemia unrelieved by nitroglycerine

Contraindications

- hypersensitivity to ASA or nonsteroidal anti-inflammatory drugs (NSAIDs)
- gastrointestinal bleeding

Adverse Reactions

- heartburn
- GI bleeding
- nausea, vomiting
- wheezing in allergic patients
- prolonged bleeding

Drug Interactions

How Supplied

- 80 mg, 160mg, or 325 mg tablets (chewable and standard)

Dosage and Administration

- 160 mg PO

Duration of Action

- onset: 30 - 45 minutes
- peak effect: variable
- duration: life of platelet (7 - 10 days)

Special Considerations

- pregnancy safety: category D
- not recommended in pediatric population

APPENDIX: Drug Formulary

AMIODARONE (CORDARONE)

Class

- antidysrhythmic

Mechanism of Action

- prolongation of action potential
- non-competitive alpha and beta sympathetic blocking effects
- calcium channel block effects

Indications

- patient with absent vital signs and either ventricular fibrillation or ventricular tachycardia on the cardiac monitor
- suppression of ventricular fibrillation refractory to defibrillation and lidocaine
- suppression of ventricular tachycardia refractory to cardioversion and lidocaine

Contraindications

- patient under the age of 16 year
- cardiac arrest possibly due to hypothermia
- patients with renal failure
- second- or third-degree heart block
- medication-induced ventricular dysrhythmias
- hypotension (cardiogenic shock)
- bradycardia
- torsades de pointes
- profound sinus bradycardia
- known hypersensitivity to oral or IV forms

Adverse Reactions

- hypotension, bradycardia, PEA, CHF
- nausea, fever, abnormal liver function test, thrombocytopenia
- pulmonary fibrosis, ARDS

Drug Interactions

- incompatible with sodium bicarbonate - causes precipitate
- compatible with bretylium, dopamine, dobutamine, isoproterenol, lidocaine, nitroglycerine, norepinephrine, phenylephrine, potassium solutions, procainamide
- fentanyl may cause hypotension, bradycardia, and decreased cardiac output
- caution with beta blockers - may increase hypotension and bradycardia
- caution with calcium channel blockers - additive effects of AV conduction/myocardial contractility, increased risk of hypotension

How Supplied

- 150 mg in 3 ml vials

Dosage and Administration

Adult

- 300 mg slow IV push - initial dose
- 150 mg slow IV push - second dose after 10 minutes if pulseless VT or VF returns
- maximum IV dose: 450 mg

APPENDIX: Drug Formulary

Pediatric

- 5 mg / kg IV/IO slow push, as a single dose
- no repeat dose is permitted

Note: intraosseous route is not permitted unless approved for use by the regional EMS medical director and the EMT is certified in the intraosseous cannulation and infusion protocol

Duration of Action

- onset: within 5 - 15 minutes
- peak effect: variable
- duration: variable

Special Considerations

- pregnancy safety: category C
- maintain at room temperature and protect from light in storage. Light protection not required during administration
- hypotension usually responsive to slowing infusion rate
- administer cautiously in patients with CHF or poor systolic function
- may be especially effective in high-risk patients with recent acute MI

APPENDIX: Drug Formulary

ATROPINE (atropine sulfate)

Class

- anticholinergic agent, parasympatholytic

Mechanism of Action

- parasympatholytic: inhibits action of acetylcholine at postganglionic parasympathetic neuroeffector sites
- increases heart rate in life-threatening bradydysrhythmias
- competitively blocks the state of acetylcholine excess associated with organophosphate and nerve gas poisoning

Indications

- cardiac arrest patient presenting in asystole on cardiac monitor but does not meet standard criteria for determination of death
- patient with cardiac electrical activity on the cardiac monitor but absent vital signs or evidence of spontaneous circulation
- hemodynamically significant bradycardia
- asystole
- organophosphate poisoning
- nerve gas exposure

Contraindications

- cardiac arrest possibly due to trauma or hypothermia
- patient meets standard criteria for determination of death
- tachycardia
- hypersensitivity
- unstable cardiovascular status in acute hemorrhage
- narrow-angle glaucoma

Adverse Reactions

- headache, dizziness, palpitations, nausea and vomiting
- tachycardia, dysrhythmias, anticholinergic effects (blurred vision, dry mouth, urinary retention)
- paradoxical bradycardia when pushed slowly or at low doses
- flushed, hot dry skin

Drug Interactions

- potential adverse effects when administered with digoxin, cholinergics, physostigmine
- effects enhanced by antihistamines, procainamide, quinidine, antipsychotics, benzodiazepines and antidepressants

How Supplied

- prefilled syringes: 1.0 mg in 10 ml of solution
- ampules: 0.4, 0.6, or 1.0 mg in 1 ml of solution

APPENDIX: Drug Formulary

BRADYDYSRHYTHMIAS

Adult & Adolescent:

- bradycardias: 0.5 mg IV bolus q 3 - 5 minutes prn to maximum total dose of 3 mg
- may be given endotracheally if IV not established 1.0 mg followed by 10 ml of normal saline

Pediatric:

- 0.02 mg/kg IV/IO (minimum dose 0.1mg) may be repeated once
- 0.02 mg/kg ETT diluted in normal saline to a total of 3 – 5 ml (minimum dose 0.1mg) may be repeated once
- maximum single dose by any route: 0.5 mg (0 – 9 years)
- mg (10 – 15 years)
- maximum total dose: 1.0 mg (0 – 9 years)
- 2.0 mg (10 – 15 years)

Asystole

Adult & Adolescent:

- asystole: 1.0 mg IV push q 3 – 5 minutes prn to maximum total dose of 3 mg
- may be given endotracheally if IV not established 2.0 mg followed by 10 ml of normal saline

Pediatric:

- 0.01 mg/kg IV/IO
- 0.1 mg/kg diluted in normal saline to a total of 3 – 5 ml repeated q 3 – 5 minutes prn

Note: intraosseous route is not permitted unless approved for use by the regional EMS medical director and the EMT is certified in the intraosseous cannulation and infusion protocol

Slow PEA

Adult & Adolescent:

- slow PEA: 1.0 mg IV push q 3 - 5 minutes if needed to maximum total dose of 3 mg
- may be given endotracheally if IV not established 2.0 mg followed by 10 ml of normal saline

Pediatric:

- 0.01 mg/kg IV/IO
- 0.1 mg/kg diluted in normal saline to a total of 3 – 5 ml repeated q 3 – 5 minutes prn

Note: intraosseous route is not permitted unless approved for use by the regional EMS medical director and the EMT is certified in the intraosseous cannulation and infusion protocol

Duration of Action

- onset: immediate
- peak effect: rapid 1 - 2 minutes
- duration: 2 - 6 hours

Special Considerations

- pregnancy safety: category C
- moderate doses dilate pupils
- much higher doses (2 - 4 mg prn) may be required to reverse effects of organophosphates and nerve gas agents

APPENDIX: Drug Formulary

D50W (DEXTROSE)

Class:

- hypertonic carbohydrate solution

Mechanism of Action

- rapidly increases serum glucose levels

Indications

- signs and symptoms consistent with hypoglycemia
- documented hypoglycemia (glucose < 4 mmol/L)

Adverse Reactions

- extravasation leads to tissue necrosis
- warmth, pain, burning, thrombophlebitis, rhabdomyositis

Drug Interactions

- sodium bicarbonate
- coumadin

How Supplied

- 25 grams / 50 ml prefilled syringes (500 mg / ml)

Dosage and Administration

Adult and adolescent (= 12 years of age):

- 25 grams slow IV (50 ml D50W); may be repeated once if serum glucose remains below 4.0 mmol/L after 5 minutes

Pediatric (< 12 years of age):

- D25W (2ml/kg IV) maximum of 50 ml
- if D25W not available, it can be prepared by diluting D50W 1:1 with sterile water

Duration of Action

- onset: < 1 minute
- peak effect: variable
- duration: variable

Special Considerations

- draw blood sugar before administering if available - if not available, do not delay administration if known diabetic with decreased level of consciousness or if clinical suspicion HIGH for hypoglycemia
- do not administer to patients with known CVA unless hypoglycemia documented

APPENDIX: Drug Formulary

DIAZEPAM (VALIUM)

Class:

- benzodiazepine, sedative-hypnotic, anticonvulsant

Mechanism of Action

- potentiates effects of inhibitory neurotransmitters
- raises seizure threshold
- induces amnesia and sedation

Indications

- patient who has a generalized seizure lasting longer than 5 minutes
- acute anxiety states, acute alcohol withdrawal, muscle relaxant, seizure activity, agitation
- sedation for medical procedures (fracture reduction, cardioversion)
- delirium tremens

Contraindications

- focal seizure with no alteration in consciousness
- hypersensitivity, coma, shock, , myasthenia gravis (disease of voluntary muscles)

Adverse Reactions

- respiratory depression, hypotension, drowsiness, ataxia
- reflex tachycardia, nausea, confusion, thrombosis and phlebitis

Drug Interactions

- incompatible with most drugs and fluids
- caution when used in intoxicated patients - can have additive effect producing further CNS depression

How Supplied

- 10 mg / 2 ml ampules or vials

Dosage and Administration

Seizure activity

Adult:

- 5 mg as an initial IV dose q 3 minutes prn
- Maximum dose: 20 mg

Adolescent:

- 2.5 mg as an initial IV dose q 3 minutes
- maximum dose: 10 mg

Pediatric:

- 0.2 mg/kg as an initial IV dose (max 2.5 mg) q 3 minutes
- maximum dose: 5 mg
- rectal administration: 0.5 mg/kg diluted to a volume of 10 cc water

Duration of Action

- onset: 1 - 5 minutes
- peak effect: 30 minutes - 2 hours
- duration: variable

Special Considerations

- pregnancy safety: category D
- short duration of anticonvulsant effect
- reduce dose 50% in elderly patient

APPENDIX: Drug Formulary

DIMENHYDRINATE (GRAVOL)

Class

- antinauseant, anticholinergic

Mechanism of Action

- blocks cellular histamine receptors
- decreases vasodilation
- decreases nausea

Indications

- symptomatic relief of nausea and vomiting

Contraindications

- glaucoma, hypertension, narrow angle glaucoma, infants
- patients taking monoamine oxidase inhibitors

Adverse Reactions

- sedation, hypotension, seizures, visual disturbances, vomiting, urinary retention, palpitations, dysrhythmias, dry mouth and throat
- paradoxical CNS excitation in children

Drug Interactions

- potentiates effects of alcohol and other anticholinergics
- MAOIs prolong anticholinergic effects of diphenhydramine

How Supplied

- tablet: 25, 50 mg
- capsules: 25, 50 mg
- 50 or 100 mg prefilled syringes, vials (IV or IM)
- elixir 12.5 mg / 5 ml

Dosage and Administration

- adult: 25-50 mg IM or IV or PO
- pediatric: 1-2 mg/kg (maximum 50 mg) IV, IO slowly or IM
 - if given PO: 5 mg / kg / 24 hours

Duration of Action

- onset: 15-30 minutes
- peak effect: 1 hour
- duration: 3-12 hours

Special Considerations

- not used in infants

APPENDIX: Drug Formulary

DIPHENHYDRAMINE (BENADRYL)

Class:

- antihistamine, anticholinergic,

Mechanism of Action

- blocks cellular histamine receptors
- decreases vasodilation
- decreases motion sickness
- reverses extrapyramidal reactions

Indications

- symptomatic relief of allergies, allergic reactions, anaphylaxis, acute dystonic reactions due to phenothiazines, motion sickness

Contraindications

- glaucoma, hypertension, narrow angle glaucoma, infants
- patients taking monoamine oxidase inhibitors

Adverse Reactions

- sedation, hypotension, seizures, visual disturbances, vomiting, urinary retention, palpitations, dysrhythmias, dry mouth and throat
- paradoxical CNS excitation in children

Drug Interactions

- potentiates effects of alcohol and other anticholinergics
- MAOIs prolong anticholinergic effects of diphenhydramine

How Supplied

- tablet: 25, 50 mg
- capsules: 25, 50 mg
- 50 or 100 mg prefilled syringes, vials (IV or IM)
- elixir 12.5 mg / 5 ml

Dosage and Administration

- adult: 25-50 mg IM or IV or PO
- pediatric: 1-2 mg/kg IV, IO slowly or IM
 - if given PO: 5 mg / kg / 24 hours

Duration of Action

- onset: 15-30 minutes
- peak effect: 1 hour
- duration: 3-12 hours

Special Considerations

- if used in anaphylaxis, often used in conjunction with epinephrine and steroids

APPENDIX: Drug Formulary

EPINEPHRINE (ADRENALINE)

Class:

- sympathomimetic

Mechanism of Action

- direct acting alpha and beta agonist
 - Alpha: bronchial, cutaneous, renal and visceral arteriolar vasoconstriction
 - Beta 1: positive inotropic and chronotropic actions, increases automaticity
 - Beta 2: bronchial smooth muscle relaxation and dilation of skeletal vasculature
- blocks histamine release

Indications

- patient with absent vital signs and either ventricular fibrillation or ventricular tachycardia on the cardiac monitor
- cardiac arrest patient presenting in asystole on cardiac monitor but does not meet standard criteria for determination of death
- patient with cardiac electrical activity on the cardiac monitor but absent vital signs or evidence of spontaneous circulation
- cardiac arrest, asystole, PEA, VF unresponsive to initial defibrillation
- severe bronchospasm, asthma, bronchiolitis
- anaphylaxis, acute allergic reactions

Contraindications

- cardiac arrest due to hypothermia
- hypertension, pulmonary edema/CHF, coronary insufficiency, hypovolemic shock
- narrow angle (congestive) glaucoma (Relative contraindication)

Adverse Reactions

- hypertension, dysrhythmias, pulmonary edema/congestive heart failure, anxiety, psychomotor agitation, nausea, angina, headache, restlessness
- overdose or inadvertent IV injection of epinephrine may cause CNS hemorrhage resulting from the sharp rise in BP

Drug Interactions

- potentiates other sympathomimetics
- deactivated by alkaline solutions
- MAOIs and bretylium may potentiate effects of epinephrine

How Supplied

- 1 mg/ml (1:1,000) or 0.1mg/ml (1:10,000) ampules and prefilled syringes
- auto-injector Epipen © 1.0 mg/ml (1:1,000) designed to deliver 0.3 mg
- auto-injector Epipen Jr© 0.5 mg/ml (1:2,000) designed to deliver 0.15 mg
- 0.01 mg/ml (1:100,000) also available

Dosage and Administration

Cardiac Arrest

Adult:

- 1 mg IV push q 3 – 5 minutes prn
- endotracheal: 2 mg diluted in 10 ml normal saline q 3 – 5 minutes prn

APPENDIX: Drug Formulary

Pediatric and Adolescent (< 16 years of age):

- IV/IO: 0.1 mg/kg repeated q 3 – 5 minutes prn
- ET: 0.1 mg/kg diluted in normal saline to a total of 3 – 5 ml repeat q 3 – 5 minutes prn

Note: intraosseous route is not permitted unless approved for use by the regional EMS medical director and the EMT is certified in the intraosseous cannulation and infusion protocol

Anaphylaxis

Adult:

- > 6 years of age: 0.3 mg IM using EpiPen® (or equivalent delivery device)
- dose may be repeated once in 10 – 15 minutes for persistent or recurrent symptoms

Pediatric and Adolescent (< 16 years of age):

- 1 – 5 years of age: 0.15 mg IM, using EpiPen Jr.® (or equivalent delivery device)
- 6 – 15 years of age: 0.3 mg IM, using EpiPen® (or equivalent delivery device)
- dose may be repeated once in 10 – 15 minutes for persistent or recurrent symptoms

Duration of Action

- onset: immediate
- peak effect: minutes
- duration: several minutes

Special Considerations

- pregnancy safety: category C
- syncope in asthmatic children
- if given via ET tube, may dilute in sterile NS (10 ml in adults)

APPENDIX: Drug Formulary

FUROSEMIDE (LASIX)

Class:

- Loop diuretic

Mechanism of Action

- inhibits electrolyte reabsorption and promotes excretion of sodium, potassium, chloride - net effect is to promote diuresis

Indications

- patient with shortness of breath and crackles in both lungs (appendix 1 of Pulmonary Edema protocol list signs suggestive of pulmonary edema)

Contraindications

- systolic blood pressure < 100 mm Hg
- known hypersensitivity to drug
- hypovolemia,

Adverse Reactions

- may exacerbate hypovolemia, hypokalemia, hypochloremia, hyponatremia, hyperglycemia (due to hemoconcentration)
- dry mouth
- may exacerbate orthostatic hypotension second degree to hypovolemia/dehydration

Drug Interactions

- lithium toxicity may be potentiated by sodium depletion
- digitalis toxicity may be potentiated by potassium depletion
- can potentiate effects of some anti-hypertensive agents (ACE inhibitors)

How Supplied

- 100 mg/5ml, 20mg/2ml, 40 mg/4 ml vials

Dosage and Administration

- 40 mg IV bolus
- if patient is taking a total daily dose > 40 mg, administer initial 40 mg IV bolus repeating 40 mg q 15 minutes prn (total maximum dose equivalent to patient's total daily dose)
- maximum total dose: 160 mg (applies even if patient's total daily dose is > 160 mg)

Pediatric:

- 1 mg / kg / dose injected slowly IV or IO

Duration of Action

- onset: 5 minutes
- peak effect: 30 minutes
- duration: 4 - 6 hours

Special Considerations

- pregnancy safety: category C
- ototoxicity and deafness can occur with rapid administration
- should be protected from light

APPENDIX: Drug Formulary

GLUCAGON

Class

- hyperglycemic agent, pancreatic hormone, insulin antagonist

Mechanism of Action

- increases blood glucose by stimulating glycogenesis (converts liver glycogen to glucose)
- unknown mechanism of stabilizing cardiac rhythm in beta- or calcium-channel blocker overdose
- minimal positive inotrope and chronotrope
- decreases GI motility and secretions - smooth muscle relaxant

Indications

- signs and symptoms consistent with hypoglycemia
- documented hypoglycemia (glucose < 4 mmol/L)
- altered level of consciousness when hypoglycemia is suspected
- may be used as inotropic or chronotropic agent in beta- or calcium-channel blocker overdose

Contraindications

- hyperglycemia
- hypersensitivity
- known pheochromocytoma (adrenal tumor that secretes excess epinephrine)

Adverse Reactions

- nausea & vomiting (occasional)
- tachycardia, hypertension

Drug Interactions

- incompatible in solution with most other substances
- no significant drug interactions with other emergency medications

How Supplied

- 1 mg ampules (requires reconstitution with diluent provided)

Dosage and Administration

Adult and Adolescent (= 10 years of age):

- 1 mg IM

Pediatric (< 10 years of age):

- 0.03 mg/kg IM (maximum 0.5 mg)

Duration of Action

- onset: 1 minute
- peak effect: 30 minutes
- duration: variable (60 – 90 minutes)

Special Considerations

- pregnancy safety: category C
- ineffective if glycogen stores depleted (chronic alcohol related liver disease)
- should always be used in conjunction with 50% dextrose whenever possible
- if patient does not respond to second dose glucagons, 50% dextrose must be administered

APPENDIX: Drug Formulary

GLUCOSE – ORAL (GLUCOLA, INTRA-GLUCOSE)

Class

- hyperglycemic agent

Mechanism of Action

- provides quickly absorbed glucose to increase blood glucose levels

Indications

- conscious patients with suspected signs and symptoms consistent with hypoglycemia
- documented hypoglycemia (glucose < 4 mmol/L)

Contraindications

- decreased level of consciousness, absent gag reflex, nausea, vomiting

Adverse Reactions

- nausea & vomiting

Drug Interactions

- none

How Supplied

- glucose pastes and gels in various forms

Dosage and Administration

Adult and Adolescent (> 10 years of age):

- 50 grams

Pediatric (< 10 years of age):

- 25 grams

Duration of Action

- onset: immediate
- peak effect: variable
- duration: variable

Special Considerations

- as noted in indications section

APPENDIX: Drug Formulary

HEPARIN SODIUM

Class

- anticoagulant

Mechanism of Action

- prevents conversion of fibrinogen to fibrin and affects clotting factors IX, XI, XIII plasmin
- does not lyse (disintegrate or dissolution) existing clots

Indications

- prophylaxis and treatment of venous thrombosis, pulmonary embolus, coronary occlusion, disseminated intravascular coagulation (DIC), post-operative thrombosis
- to maintain patency of IV injection devices and indwelling catheters

Contraindications

- hypersensitivity
- patients on antiplatelet drugs (relative contraindication)

Adverse Reactions

- hemorrhage, thrombocytopenia (persistent decrease in blood platelets), allergic reaction

Drug Interactions

- salicylates, some antibiotics and quinidine may increase risk of bleeding

How Supplied

- heparin lock flush solutions in 10 and 100 unit / ml ampules and prefilled syringes
- 1,000 – 40,000 units / ml ampules

Dosage and Administration

Adult:

- loading dose: 60 – 80 units / kg IV
- maintenance dose: 14 – 18 units / kg / hour IV

Pediatric:

- loading dose: 50 units / kg IV
- maintenance dose: 7.5 units / kg / hour IV

Duration of Action

- onset: immediate
- peak effect: variable
- duration: 4 hours after continuous infusion discontinued

Special Considerations

- heparin may be neutralized using protamine sulfate IV (1 mg protamine / 100 units of Heparin)

APPENDIX: Drug Formulary

LIDOCAINE HCl (XYLOCAINE)

Class:

- class IB antiarrhythmic, local anaesthetic

Mechanism of Action

- use dependant Na channel blocker (i.e. tends to work fairly specifically on more rapidly depolarizing ectopic foci)
- decrease the duration of the action potential by shortening repolarization
- decreases automaticity by slowing the rate of spontaneous Phase 4 depolarization

Indications

- patient with absent vital signs and either ventricular fibrillation or ventricular tachycardia on the cardiac monitor
- sustained VT with a pulse
- pulseless ventricular tachycardia or ventricular fibrillation

Contraindications

- under 16 years age
- cardiac arrest possibly due to hypothermia
- allergy or hypersensitivity to lidocaine
- third degree AV block, ventricular escape rhythms, WPW (Note: although second degree AV block is also indicated as a contraindication in several texts, it is essentially a supraventricular rhythm. If it were to appear as a post arrest rhythm, the benefit of administering lidocaine to prevent recurrence of VF or VT would outweigh the theoretical risks)
- CHF, cardiogenic shock
- Lidocaine may be used in the setting of ventricular ectopy/VT secondary to cocaine ingestion however, there is an increased risk of seizure due to the synergistic toxic effects of these two agents
- Stokes Adams Syndrome (syncope triggered by a heart arrhythmia)

Adverse Reactions

- dizziness, lightheadedness, drowsiness, slurred speech, altered mental status, confusion, blurred vision, bradycardia
- respiratory arrest (rare)
- hypotension, cardiac arrhythmias, cardiac arrest
- muscle twitching, paraesthesia (tingling in the lips and fingers)
- "ringing in the ears"
- nausea, vomiting, rash, anaphylactoid reaction
- seizures secondary to lidocaine toxicity

Drug Interactions

- increased risk of lidocaine toxicity when given to patients taking cimetidine, ranitidine or beta blockers (cimetidine inhibits the metabolism of several drugs).
- giving lidocaine to patients on disopyramide may cause bradycardia or cardiac arrest
- succinylcholine-induced apnea may be prolonged with high doses of lidocaine
- cardiac depression may occur in conjunction with phenytoin (dilatant) IV
- procainamide may exacerbate the CNS effects
- metabolic clearance decreased in patients with liver disease or those taking beta-blockers

How Supplied

- ampules of 5 ml - 20 mg/ml
- prefilled syringes of 100 mg in 5 or 10 ml
- additive syringes of 1 and 2 grams
- vials of 1 and 2 grams in 20 ml of solution

APPENDIX: Drug Formulary

Dosage and Administration

Cardiac Arrest

Adult:

- 1.0 – 1.5 mg / kg IV push
- 0.5 – 0.75 mg / kg IV dose may be repeat q 5 – 10 minutes to a maximum dose of 3 mg / kg
- ETT: two times the IV dose diluted in 10 ml normal saline. May be repeated q 5 – 10 minutes prn to a total maximum dose of 3 mg/kg

Pediatric:

- 1 mg/kg IV/IO bolus – may be repeated q 5 – 10 minutes prn
- ETT 1 mg/kg diluted in 10 ml normal saline - may be repeated q 5 – 10 minutes prn
- maximum total dose by ETT route: 3 mg/kg

Note: intraosseous route is not permitted unless approved for use by the regional EMS medical director and the EMT is certified in the intraosseous cannulation and infusion protocol

VT With Pulse

Adult:

- 1 – 1.5 mg / kg IV push, then 0.5 – 0.75 mg / kg q 5 – 10 minutes to maximum of 3 mg / kg
- initiate IV drip at 2 – 4 mg / min once VT has converted

Duration of Action

- onset: 1 - 5 minutes
- peak effect: 5 – 10 minutes
- duration: variable (15 minutes – 2 hours)

Special Considerations

- pregnancy safety: category B
- no loading dose post cardiac arrest if idioventricular rhythm, bradycardic, or third degree AV block
- reduce maintenance infusions to half loading dose (0.5 mg/kg) if Hx CHF, > 75 years of age, or liver disease
- A 75 – 100 mg bolus maintains levels for only 20 minutes
- always treat the underlying cause of ventricular ectopy first i.e. cardiac ischemia, electrolyte imbalance, hypoxemia, hypovolemia, etc.
- exceedingly high doses of lidocaine can result in coma or death
- avoid lidocaine for reperfusion dysrhythmias after thrombolytic therapy or for asymptomatic or isolated PVCs
- Lidocaine cross-reacts with other local anesthetics

APPENDIX: Drug Formulary

LORAZEPAM (ATIVAN)

Class

- benzodiazepine, sedative, anticonvulsant

Mechanism of Action

- anxiolytic, anticonvulsant and sedative effects
- suppresses propagation of seizure activity produced by foci in cortex, thalamus and limbic areas

Indications

- patient who has a generalized seizure lasting longer than 5 minutes
- initial control of status epilepticus or severe recurrent seizures
- severe anxiety
- sedation

Contraindications

- hypersensitivity
- focal seizure with no alteration in consciousness
- acute narrow-angle glaucoma
- coma, shock
- suspected drug abuse

Adverse Reactions

- respiratory depression, apnea, drowsiness, sedation, ataxia, psychomotor impairment, confusion
- restlessness, delirium
- hypotension, bradycardia

Drug Interactions

- may precipitate CNS depression if patient is already taking CNS depressant medications

How Supplied

- 0.5, 1.0, and 2.0 mg tablets

Dosage and Administration

Adult and Adolescent (10 – 15 years of age):

- 2 mg intrabucally (initial dose)
- repeat q 10 – 15 minutes
- maximum dose: 4 mg

Note: hold lorazepam if seizure stops, maximum dose is reached, or there is evidence of respiratory depression.

Pediatric (0 – 9 years of age):

- not indicated in pediatric population

Duration of Action

- onset: 1 – 5 minutes
- peak effect: variable
- duration: 6 – 8 hours

Special Considerations

- pregnancy safety: category D
- monitor blood pressure and respiratory rate during administration
- have advanced airway equipment ready and available
- inadvertent arterial injection may result in vasospasm and gangrene
- Lorazepam expires in 6 weeks if not refrigerated

APPENDIX: Drug Formulary

MIDAZOLAM

Class:

- short-acting benzodiazepine CNS depressant

Mechanism of Action

- anxiolytic and sedative properties similar to other benzodiazepines
- memory impairment

Indications

- intubated patient with increased level of consciousness in who extubation is not desirable and is either becoming distressed or at risk of destabilizing their airway
- patient who meets the indications for cardioversion as described in the unstable tachycardia treatment protocol

Contraindications

- known hypersensitivity to midazolam or other benzodiazepine
- patient age < 16 years of age
- if used for intubated patient who does not require cardioversion, hemodynamic instability (systolic BP < 90 mm Hg or pulse > 150 BPM)
- glaucoma, shock, coma, alcohol intoxication, overdose patient
- depressed vital signs
- concomitant use with other CNS depressants, barbiturates, alcohol, narcotics

Adverse Reactions

- hiccup, cough, over-sedation, nausea, vomiting, injection site pain, headache, **and** blurred vision
- hypotension, respiratory depression and arrest

Drug Interactions

- should not be used in patients who have taken CNS depressant

How Supplied

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

Dosage and Administration

Adult:

- 2 mg bolus, may be repeated q 15 minutes prn
- reduce bolus and repeat doses to 1 mg for geriatric patients and patients with pulmonary edema

Pediatric:

- not recommended

Duration of Action

- onset: 1 - 3 minutes (dose dependent)
- peak effect: variable
- duration: 2 – 6 hours (dose dependent)

Special Considerations

- pregnancy safety: category D
- administer immediately prior to intubation procedure
- requires continuous monitoring of respiratory and cardiac function
- never administer as IV bolus

APPENDIX: Drug Formulary

MORPHINE (MORPHINE SULFATE)

Class

- opioid analgesic

Mechanism of Action

- alleviates pain through CNS actions
- suppresses fear and anxiety centers in the brain
- depresses brain stem respiratory centers
- increases peripheral venous capacitance and decreases venous return
- decreases preload and afterload, decreasing myocardial oxygen demand

Indications

- chest pain due to acute coronary syndrome
- severe burns
- significant orthopedic trauma

Contraindications

- patient < 16 years of age
- undiagnosed head injury
- known hypersensitivity to morphine or other opiate analgesics
- clinic evidence of shock or respiratory depression
- exacerbated COPD, hypotension, suspected hypovolemia, decreased level of consciousness
- patients who have taken MAOIs within the past 14 days

Note: caution must be exercised when using morphine in patients with a history of asthma or underlying respiratory disease.

Adverse Reactions

- respiratory depression, hypotension, decreased level of consciousness, nausea, vomiting
- bradycardia, tachycardia, syncope, facial flushing, euphoria, bronchospasm, dry mouth

Drug Interactions

- potentiates sedative effects of phenothiazines
- CNS depressants may potentiate effects of morphine
- MAOIs may cause paradoxical excitation

How Supplied

- 10 mg in 1 ml of solution ampules

Dosage and Administration

Adult (= 16 years of age):

- 2 mg slow IV push (initial dose) repeat IV dose may be given q 5 minutes prn
- maximum total dose: 10 mg (additional doses may be given under the direction of physician online medical control (if available))

Note: morphine is administered as 1 mg / 1 ml solution only. 1 ml of 10 mg/ml morphine (from vial) is diluted with 9 ml normal saline. Do not administer undiluted morphine directly from the vial.

Duration of Action

- onset: immediate
- peak effect: 20 minutes
- duration: 2 - 7 hours

APPENDIX: Drug Formulary

Special Considerations

- pregnancy safety: on basis of historical studies, no known risk of fetal abnormality.
- morphine rapidly crosses the placenta
- safety in neonate not established
- use with caution in geriatric population and those with COPD and asthma
- vagotonic effect in patient with acute inferior MI (bradycardia, heart block)
- Naloxone should be readily available as antidote

APPENDIX: Drug Formulary

NALOXONE (NARCAN)

Class

- narcotic antagonist

Mechanism of Action

- competitive inhibition at narcotic receptor sites
- reverse respiratory depression secondary to depressant drugs
- completely inhibits the effect of morphine
- no pharmacologic activity at all in the absence of narcotic agents

Indications

- opiate overdose or decreased level of consciousness due to opiate use
- complete or partial reversal of CNS and respiratory depression induced by opioids
- reverses the effects of the following:
- morphine, heroin, hydromorphone (dilaudid), methadone, meperidine (demerol), fentanyl (sublimase), oxycodone (percodan), codeine, propoxyphene (darvon), butorphanol (stadol), pentazocine (talwin), nalbuphine (nubain)
- coma of unknown origin

Contraindications

- known hypersensitivity
- < 12 years of age

Adverse Reactions

- withdrawal symptoms in the addicted patient
- tachycardia, hypertension, dysrhythmias, nausea, vomiting, diaphoresis

Drug Interactions

- incompatible with bisulfite and alkaline solutions

How Supplied

- ampules: 0.02 mg / ml (neonate), 0.4 mg / ml, 1 mg / ml, and 2.0 mg / 5ml
- prefilled syringe: ? mg / 5 ml

Dosage and Administration

Adult and Adolescent (= 12 years of age):

- 0.4 mg IV, IM, SC as an initial dose
- repeat dose may be given q 3 – 5 minute prn
- maximum total dose: 2.0 mg

Duration of Action

- onset: within 2 minutes
- peak effect: variable
- duration: 30 - 81 minutes

Special Considerations

- pregnancy safety: safety has not been established
- seizures without casual relationship have been reported
- may not reverse hypotension
- use with caution when administering to narcotic addicts (violent behaviour, etc)
- duration of action may be shorter than the effects of long acting narcotic agents. Frequent monitoring of the patient is required and repeat doses of naloxone may be necessary

APPENDIX: Drug Formulary

NITROGLYCERIN

Class

- vasodilator

Mechanism of Action

- smooth muscle relaxant acting on vascular, bronchial, uterine and intestinal smooth muscle
- dilation of arterioles and veins in the periphery, reduces preload and afterload, decreases the workload of the heart and thereby decreases myocardial oxygen demand

Indications

- adult patients with complaint of chest pain that is suspected to be of ischemic origin (see appendix of Nitroglycerine for Ischemic Chest Pain protocol)
- patient with shortness of breath and crackles in both lungs (see appendix 1 of Pulmonary Edema Nitroglycerine protocol)
- hypertension, congestive heart failure

Contraindications

- known or suspected sensitivity to nitroglycerine
- systolic blood pressure < 100 mm Hg.
- Sildenafil (Viagra) use within 24 hours
- intracranial bleeding or head injury

Adverse Reactions

- headache, hypotension, syncope, reflex tachycardia, flushing
- nausea, vomiting, diaphoresis, muscle twitching

Drug Interactions

- additive effect with other vasodilators
- potent, refractory hypotension occurs when sildenafil (Viagra) used within 24 hours
- incompatible with other drugs when given IV

How Supplied

- tablets: , 0.3 mg,
- spray: 0.4 mg per spray
- patch: 0.2 mg/h

Dosage and Administration

Adult:

- tablets: 0.3 SL (maximum 3 doses)
- may be repeat q 5 minutes (discontinue if pain relieved or BP drops below 100 mm Hg systolic)

Note: in the event of prolonged transport times, additional doses of nitroglycerine may be administered with orders from physician via online medical control or by prior expressed written instructions from the Medical Director.

- spray: 0.4 mg SL (maximum 3 doses)
- may be repeated q 5 minutes (discontinue if pain relieved or BP drops below 100 mm Hg systolic)

Duration of Action

- onset: 1 - 3 minutes
- peak effect: 5 - 10 minutes
- duration: 20 - 30 minutes

APPENDIX: Drug Formulary

Special Considerations

- pregnancy safety: category C
- hypotension more common in geriatric population
- decomposes if exposed to light or heat
- must be kept in airtight containers
- active ingredient may have stinging effect when administered SL
- caution with use in right sided and inferior MIs

APPENDIX: Drug Formulary

NITROUS OXIDE – OXYGEN: 50:50 mixture (NITRONOX, ENTONOX)

Class

- inhaled gaseous analgesic and general anesthetic

Mechanism of Action

- exact mechanism unknown

Indications

- acute pain due to orthopedic trauma (i.e. soft tissue injury or suspected fracture), renal colic, burns, abdominal pain (not due to suspect bowel obstruction)
- moderate to severe pain
- anxiety, apprehension

Contraindications

- head injury with altered level of consciousness
- recent ingestion of liquor or illicit drugs
- major facial injuries or trauma
- known or suspect bowel obstruction
- known or suspected cardiac ischemic chest pain
- patient developing cyanosis or respiratory distress with use of nitrous oxide – oxygen
- inability to comply with instructions regarding use of nitrous oxide - oxygen
- pulse oximeter reading indicating oxygen saturation is < 90% prior to nitrous oxide – oxygen mixture use
- decompression sickness (nitrogen narcosis, air embolism, air transport)
- undiagnosed abdominal pain or marked distention, cyanosis, chest trauma with pneumothorax

Adverse Reactions

- dizziness, apnea
- expansion of gas-filled pockets
- cyanosis, nausea, vomiting, malignant hyperthermia, drowsiness, euphoria

Drug Interactions

- none of significance

How Supplied

- D and E cylinders (blue and green) of 50% nitrous oxide and 50% oxygen compressed gas

Dosage and Administration

Adult:

- instruct the patient to inhale deeply through the demand valve and mask or mouth piece

Note: invert and mix contents of cylinder several times before use – follow manufacturer's recommendations

Duration of Action

- onset: 2 - 5 minutes
- peak effect: variable
- duration: 2 – 5 minutes

Special Considerations

- pregnancy safety: nitrous oxide increases the incidence of spontaneous abortion
- ventilate patient area during use
- nitrous oxide is a non-flammable and non-explosive gas
- nitrous oxide is ineffective in 20% of the population

APPENDIX: Drug Formulary

OXYGEN

Class

- naturally occurring atmospheric gas

Mechanism of Action

- reverses hypoxemia

Indications

- confirmed or expected hypoxemia
- ischemic chest pain
- respiratory insufficiency
- prophylactically during air transport
- confirmed or suspected carbon monoxide poisoning
- all other causes of decreased tissue oxygenation
- decreased level of consciousness

Contraindications

- certain patients with COPD, emphysema who will not tolerate oxygen concentrations over 35%
- hyperventilation

Adverse Reactions

- decreased level of consciousness and respiratory depression in patients with chronic CO₂ retention
- retrolental fibroplasias if given in high concentrations to premature infants

Drug Interactions

- none

How Supplied

- oxygen cylinders (usually green and white) of 100% compressed oxygen gas

Dosage and Administration

Adult

- cardiac arrest and carbon monoxide poisoning: 100%
- hypoxemia: 10 – 15 L via non-rebreather mask
- COPD: 1 – 2 L / minute via nasal cannula or 28 – 35% venturi mask (be prepared to support ventilations if higher concentrations of oxygen needed)

Pediatric

- cardiac arrest and carbon monoxide poisoning: 100%
- hypoxemia: 10 – 15 L via non-rebreather mask
- COPD: 1 – 2 L / minute via nasal cannula or 28 – 35% venturi mask (be prepared to support ventilations if higher concentrations of oxygen needed)

Note: exception to above pediatric doses in premature infant

Duration of Action

- onset: immediate
- peak effect: not applicable
- duration: less than 2 minutes

Special Considerations

- be familiar with liter flow and each type of delivery device used
- supports combustion

APPENDIX: Drug Formulary

OXYTOCIN (PITOCIN, SYNTOCIN)

Class

- hormone

Mechanism of Action

- increases uterine contractions

Indications

- patients at > 20 weeks gestation who have delivered a newborn in the out-of-hospital environment
- patients experiencing postpartum hemorrhage of > 500 ml of blood

Contraindications

- presence of fetus not yet delivered
- patient is < 20 weeks gestation
- unfavorable fetal position
- hypersensitivity

Adverse Reactions

- hypotension, hypertension, tachycardia, dysrhythmias, angina pectoris
- anxiety, seizures, nausea, vomiting, uterine rupture
- anaphylaxis
- reddening of the skin

Drug Interactions

- other vasopressors may potentiate severe 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

Adult:

- IM administration: 10 units after delivery of all babies and placenta
- IV administration: in the event of ongoing with significant blood loss, an additional 40 IU can be added to each 1000 ml normal saline and infused based on the severity of hemorrhage and patient response
- mix 5 - 10 units in 1000 ml of NS running wide open
- never give unless all babies have been delivered

Duration of Action

- onset: 3 - 5 minutes (IM); immediate (IV)
- peak effect: variable
- duration: 30 - 60 minutes (IM); 20 minutes after infusion discontinued (IV)

Special Considerations

- pregnancy safety: not applicable
- monitor vital signs, including fetal heart rate and uterine tone closely

APPENDIX: Drug Formulary

SALBULTAMOL (VENTOLIN)

Class

- sympathomimetic, bronchodilator

Mechanism of Action

- selective β_2 agonist which stimulates adrenergic receptors of the sympathomimetic nervous system, resulting in smooth muscle relaxation in the bronchial tree and peripheral vasculature
- little action of β_1 receptors in cardiac muscle

Indications

- patients with signs or symptoms of respiratory distress (see Bronchospasm protocol)
- treatment of bronchospasm in patients with reversible obstructive airway disease (COPD / asthma)

Contraindications

- < 1 year of age

Adverse Reactions

- restlessness, tremors, dizziness, palpitations, tachycardia, nervousness, peripheral vasodilation, nausea, vomiting, hyperglycemia, increased blood pressure and paradoxical bronchospasm
- synergistic with other sympathomimetics

Drug Interactions

- tricyclic antidepressants and MAOIs may potentiate effects on vasculature - use with caution
- beta-blockers are antagonistic
- may potentiate hypokalemia caused by diuretics

How Supplied

- packaged, prepared nebulas (2.5 mg)
- metered dose inhaler: 90 mcg / metered spray (17 gram canister with 200 inhalations)

Dosage and Administration

Adult:

- administer 2.5 mg inhalation with 2.5 ml normal saline in nebulizer
- second dose may be given q 15 minutes prn
- subsequent repeat doses may be given q 15 minutes prn

Pediatric:

- administer 2.5 mg inhalation with 2.5 ml normal saline in nebulizer
- second dose may be given q 15 minutes prn
- subsequent repeat doses may be given q 15 minutes prn

Duration of Action

- onset: 5 - 15 minutes
- peak effect: 60 - 90 minutes
- duration: 3 - 6 hours

Special Considerations

- pregnancy safety: has been used in pregnant women for many years without apparent ill consequence
- antagonized by beta-blockers
- may precipitate angina pectoris and dysrhythmias
- should only be administered by inhalation methodology in out-of-hospital management