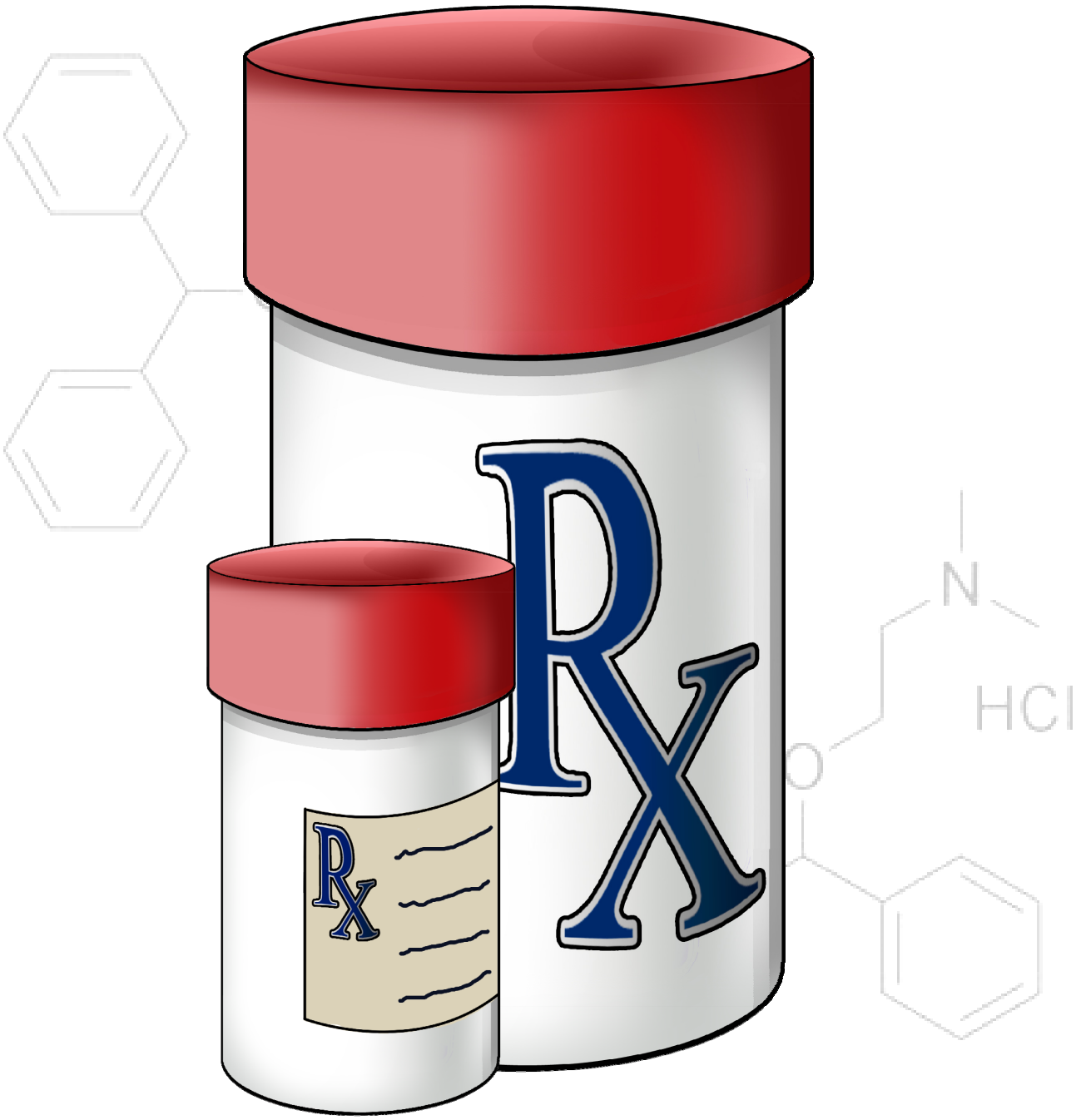
EMT Paramedic Program



Student Drug Reference Manual

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January 2008

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Pharmacology Fundamentals Review

Pharmacology: Study of drugs (origin, chemical composition, indications, effects on the body).

Drug: Chemical substance that produces a response when administered to an organism in the body.

Drug Sources: 1) Plants 3) Minerals
2) Animals 4) Synthetic

Drug Terminology: 1) Chemical (structure and composition of a drug)
2) Generic (abbreviated version of the chemical name; a drug produced and distributed without patent protection)

3) Trade (name given to a generic drug by a specific manufacturer for marketing purposes)

Drug Half-Life:
- Time required for the drug's plasma concentration to be reduced by **half** its original level.
- Two major factors determine a drug's *half-life*:

1) Biotransformation
2) Elimination

Pharmacokinetics

Pharmacokinetics: Study of movement of a drug within the body**.**

Absorption: Movement of a drug from the site of administration into the bloodstream.

Primary routes of administration:

1. **Enteral**: Medication enters through GI tract.
   - Absorption occurs in the stomach and small intestine – primarily in the duodenum (the first part of the small intestine immediately below the stomach.).
   - Factors effecting oral drug absorption:
     - Hepatic portal system
     - Food
     - pH
     - Peristaltic movement
     - Crushing/chewing
     - Fluid intake

   - Factors effecting rectal drug absorption:
     - Feces
     - Incontinence

2. Parenteral:

- IV/IO
- Endotracheal
- Inhalation
- SC
- IM
- SL
- IL
- Topical
- Transdermal

General factors affecting drug absorption:

- Circulatory status
- Drug solubility
- pH
- Concentration
- Body temperature
- Site of absorption
- Surface area
- Blood supply

Distribution: Three factors influence the site of absorption at the site of action (target cell):
- Blood flow
- Capillary permeability
- Binding of drugs to proteins

1. **Blood flow:** Drugs tend to become concentrated in areas of greater vascular activity (in the heart, brain, lungs, liver, kidneys). Two factors influence the blood supply:

   - Body temperature
   - Cardiac output

2. **Capillary permeability:** Permeability is based on two factors:

   - Capillary structure (slit junctions, blood brain barrier)
   - Chemical composition (lipid soluble)

3. **Binding of drugs to proteins:** Drugs may bind with serum proteins and become ineffective:

   - Albumin is most the common. protein
   - Drug in contact with serum protein is considered **bound**.
   - Remaining drug circulation is unbound and is considered **free**.
   - Degree to which a drug is bound is called the **binding capacity**.

During the process of distribution, the body maintains homeostasis by monitoring the amount of free drug(s) vs. the amount of bound drug(s).

- After a *free drug* acts on the target tissue and is eliminated, *bound drugs* are released from inert binding sites.
- This process limits the amount and concentration of the *free drug* reaching the target tissue.

Biotransformation: Series of chemical alterations within the body that changes the drug to an active or inactive state (metabolism).

- End product is called a **metabolite**.

The purpose of biotransformation is to:

- Activate a drug.
- Inactivate a drug.
- Provide easier excretion from the body.

The results of altered biotransformation are:

- If biotransformation is slowed, the result is an increase in the circulation of *free drugs* that may lead to drug **toxicity**.
- If biotransformation is accelerated, the result is a decrease in the circulation of *free drugs* that may lead to drug **tolerance.**

Elimination: Removal of waste products from the body as original drug form (kidneys) or as *metabolites* (liver).

Alterations to the removal of waste products (*elimination*) results in either one of two scenarios:

- Accelerated excretion and short-term drug action that may lead to *drug tolerance*.
- Slow excretion and prolonged drug action that may lead to *toxicity*.

Pharmacodynamics

Pharmacodynamics: Study of drug action on the body that occurs when a drug reaches target tissue receptors.

Receptor Theory:

- Most drugs produce a response by binding to receptors (Lock and Key).
- Receptor availability determines the quantity of drug necessary to trigger a response.

Factors that affect drug response:

- Affinity (their attraction) to receptors.
- Amount of receptors located in an individual.
- Alteration to the drug structure may result in an increase or decrease in the drug's ability to bind to a receptor.

Efficacy: Ability to produce a response when interaction with a receptor occurs.

Agonist: Drugs that bind to a receptor and produce a response (a*ffinity and efficacy*).

Antagonist: Drugs that bind to a receptor but **do not** produce a response (a*ffinity* only).

Therapeutic Threshold/Minimum Effective Concentration: This refers to the minimum amount of drug(s) required to achieve the desired response. Implications include:

- **Decreased** concentrations can result in **no response**.
- **Increased** concentrations can result in **toxicity**

The goal of drug therapy is to give the minimum dosage and concentration of a drug necessary to obtain desired response.

Therapeutic Index: Difference between the minimum effective concentration of the drug and toxic levels. It varies from drug to drug.

- Most drugs have a predetermined standard dosage range.
- The dosage can also be calculated according to the patient's weight.

The Central Nervous System (CNS)

Parasympathetic Nervous System (PNS):

- Originates in the brain stem and sacral segments.
- Vegetative function.
- Vagus nerve.
- The neurotransmitter is acetylcholine.
- Erased by acetylcholinesterase.
- Vagus nerve stimulation on the myocardium effects atria, **not** ventricles.

Sympathetic Nervous System (SNS):

- Excites a response.
- Fight or Flight.
- Originates in the thoracic and lumbar segments.
- Main neurotransmitter is norepinephrine.
- Sympathetic nerve stimulation on myocardium works on both atria and ventricles.

Functions of Adrenal Medulla:

- **Adrenergic**: Stimulates tissue not innervated by sympathetic nerves.
- **Cholinergic:** Prolongs the effects of direct sympathetic stimulation.

1. Adrenergic:

- Sympathetic nervous system.
- Adrenergic (sympathomimetic) drugs initiate action of epinephrine and norepinephrine.
- Drugs opposing the action of epinephrine and norepinephrine are called. antiadrenergic drugs (sympatholytics).
- Adrenergic receptors are Alpha (α) and Beta (β).

2. Cholinergic:

- Parasympathetic nervous system.
- Activated by acetylcholine.
- Cholinergic drugs (parasympathomimetics) initiate the action of acetylcholine.
- Drugs opposing the actions of acetylcholine are called anticholinergics (parasympatholytics).

Alpha $_1$ - Vessels:

- Peripheral vasoconstriction increases blood pressure (primary response).
- Mild bronchoconstriction.
- Stimulation of metabolism.

Alpha $_2$ - Vessels:

- Inhibits the release of additional norepinephrine resulting in peripheral vasodilation.

Beta $_1$ - Heart:

- Positive chronotropic effects lead to increased heart rate.
- Positive inotropic effects lead to increased force and contractility.
- Positive dromotropic effects lead to increased conduction.
- Increased automaticity (the ability to generate an electrical impulse **without** nervous system stimulation).

There are two implications of Beta$_1$ stimulation:

- Increased myocardial irritability leading to dysrhythmias.
- Increased myocardial O_2 demand which leads to ischemia.

Beta $_2$ - Lungs:

- Bronchodilation (primary)
- Peripheral vasodilation (mild)

Dopaminergic: Vasodilation of renal, mesenteric, coronary and cerebral vessels resulting in increased oxygen perfusion.

Common Abbreviations:

ā	before	pr	per rectum
a.c.	before meals	prn	when necessary
bid	twice a day	q	every
hs	at bedtime	qd	everyday
od	once daily	qid	four times a day
p	after	qh	every hour
pc	after eating	qod	every other day
po	by mouth	tid	three times a day

The Five Rights of Drug Administration:

1) Right patient
2) Right medication
3) Right dose
4) Right route
5) Right time and frequency

Drug Calculations Review

Drug administration: $\frac{\text{Desired dose (mg)} \times \text{Vehicle (mL)}}{\text{Available dose (mg)}} = \text{mL}$

Drug infusion rate: $\frac{\text{Desired dose (mg/min)} \times \text{Vehicle (mL)} \times \text{Drop set (gtts/mL)}}{\text{Available dose (mg)}} = \text{Drops/min}$

IV pump infusion rates: $\frac{\text{Desired dose (mg/min)} \times 60 \text{ (min/hr)}}{\text{Drug concentration (mg/mL)}} = \text{mL/hr}$

IV infusion rate: $\frac{\text{Amount to be infused (mL)} \times \text{Drop set (gtts/mL)}}{\text{Time (min)}} = \text{drops/min}$

Desired Dose: Amount of drug to be administered (i.e. mg, mg/kg, µg/kg/min etc…).

Vehicle: Amount of fluid the drug is supplied in or will be administered in (i.e. morphine is supplied 10 mg/1 mL - 1 mL is the vehicle. Lidocaine infusion is prepared by adding 1 g/250 mL NS - 250 mL is the vehicle).

Available Dose: Total amount of drug available in a solution or total amount of drug added to an infusion (i.e. morphine is supplied 10 mg/1 mL - 10 mg is the available dose. Lidocaine infusion is prepared by adding 1 g/250 mL NS - 1 g is the available dose).

GENERAL INFUSION RATES FOR VARIOUS MEDICATIONS **1 g of drug in 250 mL N/S using 60 gtts set**		
1mg/min = 15 gtts/min	5 mg/min = 75 gtts/min	9 mg/min = 135 gtts/min
2 mg/min = 30 gtts/min	6 mg/min = 90 gtts/min	10 mg/min = 150 gtts/min
3 mg/min = 45 gtts/min	7 mg/min = 105 gtts/min	11 mg/min = 165 gtts/min
4 mg/min = 60 gtts/min	8 mg/min = 120 gtts/min	12 mg/min = 180 gtts/min

Comprehensive Drug List

acetaminophen (Tylenol)
acetylcysteine (Mucomyst; Mucosil)
acetylsalicylic acid (Aspirin)
activated charcoal (Charcodote; Charac-50)
adenosine (Adenocard)
albumin (Plasbumin 5; Plasbmin 25)
alteplase (Activase r-tPA)
aminophylline (Pyllocontin)
amiodarone (Cordarone, Pacerone)
atenolol (Tenormin)
atropine
benztropine (Cogentin)
calcium chloride
cefazolin (Kefzol; Ancef; Zolicef)
chlorpromazine (Largactil)
cimetidine (Tagamet)
clopidogrel (Plavix)
codeine
dexamethasone (Decadron; Hexadrol)
dextrose 50% ($D_{50}W$)
diazepam (Valium)
diazoxide (Hyperstat)
diltiazem (Cardizem)
digoxin (Lanoxin)
dihydroergotamine (DHE)
dimenhydrinate (Gravol) 6
diphenhydramine (Benadryl)
dobutamine (Dobutrex)
dopamine (Revimine; Intropin)
droperidol (Inapsine)
enoxaparin (Levenox)
epinephrine 1:1000/1:10,000 (Adrenalin)
esmolol (Brevibloc)
etomidate (Amidate)
fentanyl (Sublimaze)
flumazenil (Anexate)
furosemide (Lasix)
glucagon
glucose (oral) (Glucosa; Insta-glucose)
haloperidol (Haldol)
heparin (Hepalean)
hydralazine (Apresoline)
hydrocortisone (Solu-Cortef)
ibuprofen (Motrin; Advil)
insulin (Regular; Toronto; CZI)
ipratropium (Atrovent)
ipratropium/fenoterol (Duovent)
ipratropium/salbutamol (Combivent)
Isoproterenol (Isuprel)
ketamine (Ketalar
ketorolac (Toradol)
labetalol (Normodyne; Trandate)
lidocaine (Xylocaine)
lidocaine HCl (Xylocaine Endotracheal)
lorazepam (Ativan)
magnesium sulfate
mannitol (Osmitrol)
meperidine (Demerol)
methylprednisolone (Solu-Medrol)
metoclopramide (Maxeran; Reglan)
metoprolol (Lopressor; Betaloc)
midazolam (Versed)
morphine
nalbuphine hydrochloride (Nubain)
naloxone (Narcan)
neostigmine (Prostigmin
nitroglycerin (Nitrostat: Nitro-Bid)
nitroglycerin IV (Nitrostat IV; Nitro-Bid IV)
nitrous oxide (Entonox; Nitronox)
norepinephrine (Levophed)
oxygen
oxytocin (Syntocinon; Pitocin)
pancuronium (Pavulon)
pentastarch (Pentaspan)
phenobarbitol (Luminal)
phentolamine (Rogitine)
phenytoin (Dilantin)
potassium chloride (Slow-K; K-Dur)
prednisolone (Prelone)
procainamide (Pronestyl)
prochlorperazine (Stemetil)
propranolol (Inderal)
propofol (Diprivan
racemic epinephrine (Vaponefrin)
ranitidine (Zantac)
reteplase (Retavase)
rocuronium (Zemuron)
salbutamol (Ventolin)
sodium bicarbonate
sodium nitroprusside (Nipride)
streptokinase (Streptase)
succinylcholine (Anectine)
tenecteplace (TNK)
tetanus toxoid
thiamine (Betaxin)
thiopental (Pentothal)
vasopressin (Pitressin)
vecuronium (Norcuron)
verapamil (Isoptin)

acetaminophen **Tylenol, Tempra**

CLASSIFICATION(S):
Analgesic; Antipyretic

INDICATION(S):
1. Treatment of mild pain.
2. Reduction of fever.
3. Provides symptomatic relief only.

THERAPEUTIC ACTION(S):
1. Acts on the hypothalamic heat regulating centre to produce peripheral vasodilation resulting in increased blood flow through the skin, sweating and heat loss. It also blocks prostaglandin synthesis in the hypothalamus.
2. Nonsalicylate analgesic (antipyretic).
3. Inhibits prostaglandin synthesis in the central nervous system and to a lesser extent, through a peripheral action by blocking pain impulse generation.
4. Acetaminophen has minimal anti-inflammatory activity.
5. 90-95 percent of a dose is metabolized in the liver, primarily by conjugation with glucuronic acid, sulfuric acid, and cysteine.

ADVERSE EFFECT(S):
When used as directed, acetaminophen is virtually free of severe toxicity or side effects.

PRECAUTION(S):
1. Chronic alcohol abuse predisposes patients to acetaminophen hepatotoxicity even in therapeutic doses.
2. Barbiturates may enhance the metabolism of acetaminophen.
3. May cause impaired liver function, including hepatitis.
4. May be safely used short-term during pregnancy (has been proven to cross the placenta).

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
PO

ADULT DOSAGE:
650 – 1000 mg q 4-6 hours, p.rn.; daily dose not to exceed 4000 mg.

PEDIATRIC DOSAGE:

10 – 15 mg/kg q 4-6 hours, prn; max dose 65 mg/kg/24 hrs, or 5 doses.

SUPPLIED FORM(S):

Tablet: 325 or 500 mg

Pediatric Preparation(s):

Liquid: 80 mg/mL, 160 mg/5 mL

Tablet: 80 or 160 mg

ADDITIONAL INFORMATION:

1. Acetaminophen is commonly seen in cases of overdose and may result in severe hepatic damage. A latent period of 24-36 hours exists between ingestion and the onset of symptoms of hepatic injury. Treatment should be initiated as soon as possible and should include administration of activated charcoal and acetylcysteine (Mucomyst) which is effective in preventing acetaminophen-induced hepatotoxicity.
2. Toxic levels of acetaminophen:
   - Children: ≥ 150 mg/kg
   - Adult: ≥ 150 mg/kg or a total dose of 7.5 grams.

acetylcysteine **Mucomyst; Mucosil; Parvolex**

CLASSIFICATION(S):
Mucolytic agent; Antidote

INDICATION(S):
To prevent or lessen hepatic injury that may occur after ingestion of a hepatotoxic dose of acetaminophen.

THERAPEUTIC ACTION(S):
1. Protects liver cells by maintaining or restoring glutathione levels or by acting as an alternate substrate for conjugation and detoxification of acetaminophens (reactive *metabolite*).
2. Deacetylated by the liver to cysteine and subsequently metabolized.

ADVERSE EFFECT(S):

CNS
Drowsiness

RESP
Bronchospasm, chest tightness

CVS
Tachycardia, hypotension, hypertension

GI
N/V

Other
Rhinorrhea, fever

PRECAUTION(S):
1. Asthmatics (risk of bronchospasm).
2. Esophageal varices.
3. Peptic ulcer.
4. Dilution with saline minimizes the risk of vomiting.

CONTRAINDICATION(S):
None when used as an antidote.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
150 mg/kg in 250 mL NS over 15 minutes,
50 mg/kg in 500 mL NS over 4 hours,
100 mg/kg in 1000 mL NS over 16 hours,

Total 300 mg/kg in 20 hours. Administer full doses unless blood work reveals a non-toxic level of acetaminophen.

PEDIATRIC DOSAGE:
Dosage is the same as for adults. Mix all concentrations to a max concentration of 58 mg/ml.

SUPPLIED FORM(S):
Ampule: 200 mg/mL ampule, 20% solution

ADDITIONAL INFORMATION:
1. To be effective in protecting against severe liver damage, therapy with acetylcysteine must be started within 10 hoursof acetaminophen ingestion (outer limit is 24 hours, however the *efficacy* of acetylcysteine is decreased).
2. Monitor hepatic and renal function, fluid balance, and electrolytes.
3. If possible, draw blood first.
4. Toxic levels of acetaminophen:
   - Children: ≥ 150 mg/kg,
   - Adult: ≥ 150 mg/kg or a total dose of 7.5 grams.
5. When the medication is mixed - a slight purple discolouration may occur.

acetylsalicylic acid (ASA) Aspirin

CLASSIFICATION(S):
Platelet Aggregation Inhibitor; Analgesic; Anti-inflammatory; Antipyretic

INDICATION(S):
1. Anti-platelet therapy in acute coronary syndrome (ACS).
2. Used early in the treatment of MI to reduce infarct size and mortality.
3. Offers relief of mild pain, fever and inflammation due to a variety of conditions.

THERAPEUTIC ACTION(S):
1. ASA affects platelet function by inhibiting the enzyme prostaglandin cyclooxygenase in platelets, thereby preventing the formation of the aggregating agent thromboxane A_2. ASA may also inhibit formation of the platelet aggregation inhibitor prostacyclin (prostaglandin I_2).
2. ASA's effects on platelets are irreversible and last the life of each platelet.
3. Salicylate competitively inhibits prostaglandin synthesis activity in various tissues, thereby producing peripherally mediated analgesia, anti-inflammatory and antipyretic effects.

ADVERSE EFFECT(S):

CNS
Confusion, drowsiness

GI
GI bleeding, ulcerations, gastritis, N/V, esophageal reflux

Other
Petechiae, prolonged bleeding time, tinnitus

PRECAUTION(S):
1. For patients receiving anticoagulant therapy (i.e. Warfarin), ASA may potentiate the effect.
2. Diabetics receiving salicylate and hypoglycemic therapy concurrently (oral hypoglycemics or insulin) should be monitored closely for hypoglycemia.
3. Hypersensitivity to NSAIDS.

acetylsalicylic acid (ASA) Aspirin

CONTRAINDICATION(S):

1. Hypersensitivity to salicylates.
2. In 20 percent of asthmatics, ASA may produce bronchospasm.
3. In patients with active ulcer disease, it may lead toactive GI hemorrhage.
4. In children and adolescents with an acute febrile illness especially influenza or varicella, the administration of ASA places the child at risk of developing Reye's Syndrome.
5. Bleeding disorders including coagulation or platelet function disorders.
6. Pregnancy (especially during the third trimester).

ROUTE(S) OF ADMINISTRATION:

PO

ADULT DOSAGE:

Platelet Aggregation Inhibitor

160 mg PO x 1; chew tablets before swallowing

Analgesic/Antipyretic

325-650 mg PO q 4 hours pm

Anti-inflammatory

975 mg PO q 4-6 hours pm

PEDIATRIC DOSAGE:

Ibuprofen or acetaminophen are preferred for pediatric use.

SUPPLIED FORM(S):

Tablet: Children's ASA 80,
Adult's ASA 325 or 500 mg

ADDITIONAL INFORMATION:

1. Reye's Syndrome is an acute, often fatal disease of childhood, characterized by acute edema of the brain, hypoglycemia, fatty infiltration and liver dysfunction.
2. In AMI patients, ASA decreased five week mortality by 23 percent (ISIS-2 study).
3. Baby ASA is recommended because it is more palatable.
4. The overdose amount of ASA requiring treatment is 200 mg/kg.

activated charcoal **Charcodote; Charac-50**

CLASSIFICATION(S):
Adsorbent

INDICATION(S):
Practically all oral poisonings and overdoses:

1. Following emptying of stomach (Lavage).
2. As a stand alone treatment (current trends suggest against avage).
3. When vomiting is contraindicated.
4. Especially effective in binding acetylsalicylic acid, amphetamines, strychnine, phenytoin and phenobarbital.
5. Multiple dose therapy is indicated in the treatment of severe intoxications with drugs that are secreted into the stomach or that undergo clinically significant enterohepatic or enteroenteric cycling; or drugs that have low intrinsic clearances, long *half-lives* and nonrestrictive protein binding. Examples of these drugs are: Carbamazepine, dapsone, phenobarbitol, quinine and theophylline.

THERAPEUTIC ACTION(S):

1. **Single dose**: Adsorbs toxic substances in the GI tract by forming an effective barrier between any remaining particulate material and the GI mucosa.
2. **Multiple dose therapy**: Creates and maintains a concentration gradient across the wall of the gastrointestinal tract that facilitates passive diffusion of the toxic substance from the blood stream into the gastrointestinal tract lumen where it is adsorbed, and thereby prevented from being reabsorbed.
3. Activated charcoal is not metabolized by the body.

ADVERSE EFFECT(S):

GI
Constipation, N/V, black feces

PRECAUTION(S):

1. Decreased LOC (ensure airway patency).
2. Impaired gastrointestinal motility.
3. Absence of bowel sounds.

CONTRAINDICATION(S):

1. Corrosives, caustics or petroleum distillates may induce vomiting with the potential of aspiration.
2. Gastrointestinal hemorrhage or perforation.
3. Electrolyte imbalance.

activated charcoal **Charcodote; Charac-50**

ROUTE(S) OF ADMINISTRATION:
PO; NG

ADULT DOSAGE:
Single dose therapy
0.5 – 1 g/kg PO

Multiple dose therapy
0.25-0.5 g/kg q 1-6 hours (q 1 hour is most common)

Discontinue when laboratory parameters, including serum drug concentrations, are improving.

PEDIATRIC DOSAGE:
Same as adult.
Do not use charcoal containing **sorbitol** (a sugar substitute).

SUPPLIED FORM(S):
Bottle: 50 g/250 mL oral suspension (200 mg/mL)

ADDITIONAL INFORMATION:
1. Ineffective in adsorbing caustic alkalis, boric acid, lithium, ethylene glycol, iron salts, mineral acids, ethanol, methanol and organophosphates.
2. For maximum effect, administer activated charcoal within 60 minutes of post toxic ingestion.
3. Sorbitol is added to some forms of activated charcoal to produce a hyperosmotic laxative action to promote elimination of the toxic substance.
4. Shake bottle vigorously before administration.

CLASSIFICATION(S):
Antidysrhythmic

INDICATION(S):
PSVT (re-entry pathway involving AV or SA node)

THERAPEUTIC ACTION(S):
1. Adenosine is a pure endogenous purine nucleoside that slows conduction through the AV node and interrupts AV nodal re-entry pathways.
2. Interrupts re-entry pathways through the AV and SA node.

ADVERSE EFFECT(S):

CNS
Dizziness, apprehension, feelings of impending doom

RESP
Dyspnea/SOB, hyperventilation

CVS
Chest pressure (mimics ischemic chest pain), dysrhythmias, facial flushing

GI
Nausea
Adverse effects are transient in nature resolving spontaneously in about 10-15 seconds

PRECAUTION(S):
1. During conversion from PSVT, various dysrhythmias may be seen; i.e., sinus bradycardia or tachycardia, PACs, PVCs, various degrees of heart blocks and asystole.
2. Does not convert atrial flutter, atrial fibrillation and ventricular tachycardia.
3. May cause hypotension with large doses (more than12 mg) by reducing peripheral vascular resistance.
4. If administered for Wide Complex Tachycardia/VT, may cause deterioration including hypotension.
5. May cause severe bronchospasm in patients with asthma and COPD.
6. Patients with a pre-existing propensity to bradycardias or conduction defects and who do not have a functioning pacemaker because of the risk of prolonged sinus arrest or AV block.
7. Patients with denervated, transplanted hearts.

CONTRAINDICATION(S):

1. Second or third degree heart block.
2. Sick sinus syndrome.
3. Hypersensitivity.
4. Poison/drug-induced tachycardia.

ROUTE(S) OF ADMINISTRATION:

Rapid IV bolus, utilize the closest IV drug port to the IV injection site

ADULT DOSAGE:

6 mg rapid IV bolus (1-2 seconds) followed by a 20 mL saline flush. If no response, repeat q 1-2 minutes at **12 mg** rapid IV bolus. If still no response, repeat **12 mg** dose x 1.

If no conversion occurs after three doses and the patient remains hemodynamically stable and in a narrow complex rhythm, then utilize calcium channel blockers or beta blockers.

PEDIATRIC DOSAGE:

Initial dose: **0.1 mg/kg**; max 6 mg
Second dose: **0.2 mg/kg**; max 12 mg

Follow all dosages with a rapid bolus of 2-5 mL NS.

SUPPLIED FORM(S):

Vial/preload: 6 mg/2 mL, 12 mg/4 mL

ADDITIONAL INFORMATION:

1. Adenosine's *half-life* is less than ten seconds.
2. PSVT may recur in minutes/hours, post-treatment of adenosine, so be prepared to administer a calcium channel blocker or beta blocker.
3. Sixty percent of patients with PSVT convert to NSR after a 6 mg dose.
4. Ninety two percent of patients with PSVT convert to NSR after a 12 mg dose.
5. Conversion usually takes place in 10–30 seconds.

DRUG INTERACTION(S):

1) Methylxanthines (caffeine and theophylline):

Prevents adenosine from binding to receptor sites (larger dose may be required).

2) Dipyridamole (Persantine):

Adenosine effects are potentiated by inhibiting cellular uptake, therefore a smaller dose may be required. Aminophylline can be used to reverse the adenosine mediated adverse effects of dipyridamole.

3) **Carbamazepine (Tegretol):**

Adenosine administration may produce higher degrees of heart block in the presence of carbamazepine.

albumin 5%/albumin 25% **Plasbumin-5; Plasbumin-25**

CLASSIFICATION(S):
Blood product; Plasma protein; Volume expander

INDICATION(S):
Emergency treatment of hypovolemic shock:

Albumin 5% is best indicated in conditions with a volume deficit.
Albumin 25% is best indicated in conditions with an oncotic deficit, however, if used in situations of a volume deficit additional crystalloid should be administered.

THERAPEUTIC ACTION(S):
Increases plasma colloid osmotic pressure, which mobilizes fluids from interstitial space into intravascular space.

Plasbumin-5% is iso-oncotic and will expand the circulating blood volume by an amount approximately equal to the volume infused.
Plasbumin-25% is hypertonic and will expand the plasma volume by an additional three to four times the actual volume administered.

ADVERSE EFFECT(S):
Adverse effects are rare, however if they do occur they tend to be allergic in nature.

PRECAUTION(S):
1. Observe closely for signs of circulatory overload.
2. Observe for signs of dehydration (provide additional crystalloid if required).
3. In hemorrhagic shock, albumin administration should be supplemented with whole blood to treat relative anemia associated with hemodilution.
4. Albumin administration results in a rapid rise in BP, which warrants careful observation to detect and treat severed blood vessels which may not bleed at lower pressures.
5. Hepatic/renal impairment.

CONTRAINDICATION(S):
1. Hypersensitivity.
2. Cardiac failure, pulmonary edema, renal insufficiency, stabilized chronic anemia (circulatory overload).
3. Ability to treat and stabilize with crystalloid.

ROUTE(S) OF ADMINISTRATION:
IV infusion

albumin 5%/albumin 25% **Plasbumin-5; Plasbumin-25**

ADULT DOSAGE:

albumin 5%

500 mL rapid IV infusion titrated to effect, repeat x 1 in 30 minutes, or infuse an amount equal to the estimated volume deficit.

albumin 25%

Volume and speed of administration should be titrated to effect.

PEDIATRIC DOSAGE:

Limited information.

SUPPLIED FORM(S):

Plasbumin-5 (albumin 5%)

Vial: 2.5 g/50 mL, 12.5 g/250 mL, 25 g/ 500 mL

Plasbumin-25 (albumin 25%)

Vial: 5 g/20 mL, 12.5 g/50 mL, 25 g/ 100 mL

ADDITIONAL INFORMATION:

1. Once the vial has been punctured, the product is viable to a maximum of four hours.
2. Store at room temperature.
3. Albumin is a human blood product, therefore precautions must be employed to protect against infections such as hepatitis and HIV.

alteplase Activase r-tPA (recombinant tissue plasminogen activator)

CLASSIFICATION(S):
Fibrinolytic/Thrombolytic Agent

INDICATION(S):
1. AMI (to reduce CHF, improve ventricular function, and reduce mortality)
    - ST elevation (≥ 1 mm in ≥ 2 contiguous leads) or new or presumably new LBBB; strongly suspicious for injury (BBB obscuring ST analysis).
    - Time from onset of symptoms, less than 12 hours.
2. Acute Ischemic Stroke (Alteplase is the only fibrinolytic agent approved for acute ischemic stroke).
    - Sudden onset of focal neurologic deficits or alterations in consciousness.
    - Absence of intracerebral or subarachnoid hemorrhage or mass effect on CT scan.
    - Absence of variable or rapidly improving neurologic deficits.
    - Alteplase can be started in less than three hours from symptom onset.

THERAPEUTIC ACTION(S):
1. When a clot is formed, an inactive plasma enzyme called plasminogen is incorporated into the clot. Body tissues, blood, and introduced agents (alteplase) contain substances that can activate plasminogen to plasmin, an active enzyme. Once plasmin is formed, it can dissolve the clot by digesting fibrin threads and by inactivating substances such as fibrinogen, prothombin, and factors V, VIII, and XII.
2. Binds to fibrin in a thrombus and converts the entrapped plasminogen to plasmin, initiating local fibrinolysis with limited systemic proteolysis.
3. Clot dissolution and reperfusion occur with a higher frequency when the therapy is initiated earlier since clots become more resistant to lysis with age.

ADVERSE EFFECT(S):

CVS
Chest pain or reperfusion dysrhythmias (accelerated idioventricular, sinus bradycardia, second and third degree heart blocks)

HEMAT
Internal bleeding (GI, GU, RESP tract, retroperitoneal, intracranial); superficial or surface bleeding (primarily at puncture sites)

GI
N/V, fever

alteplase Activase r-tPA (recombinant tissue plasminogen activator)

PRECAUTION(S):

1. Recent major surgery within ten days.
2. Hx or evidence of TIA.
3. Recent GI/GU bleeding within ten days.
4. Recent trauma within ten days (including CPR).
5. Hx or evidence of uncontrolled hypertension.
6. More than 75 years of age.
7. Left heart thrombus (mitral stenosis with A-Fib).
8. Hemostatic defects including those secondary to severe hepatic or renal disease.
9. Liver dysfunction.
10. Post-partum state.
11. Diabetic hemorrhagic retinopathy.
12. Other hemorrhagic ophthalmic conditions.
13. Septic thrombophlebitis.
14. Patients currently receiving oral anticoagulants.
15. Known bleeding disorders.
16. Terminal illness.
17. Infective endocarditis.
18. Any other condition in which bleeding presents a significant hazard or it's difficult to manage due to the location.

In all of the above, the benefit must clearly outweigh the risk for thrombolytic use.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Active internal bleeding.
3. Hx of CVA (within two months).
4. Suspected subarachnoid hemorrhage.
5. Recent intracranial, intraspinal surgery or trauma (within two months).
6. Intracranial neoplasm, AV malformation or aneurysm.
7. Severe uncontrolled hypertension (i.e. diastolic > 110 mmHg &/or systolic > 180 mmHg).
8. Aortic dissection.
9. Acute pericarditis.

ROUTE(S) OF ADMINISTRATION:

IV infusion

alteplase Activase r-tPA (recombinant tissue plasminogen activator)

ADULT DOSAGE:

AMI

Accelerated infusion (1.5 hours)

15 mg IV bolus, then **0.75 mg/kg** (max 50 mg) over next 30 minutes, then **0.50 mg/kg** (max 35 mg) over next 60 minutes.

3 hour infusion

60 mg in first hour (initial 6 to 10 mg is given as a bolus), then **20 mg/hour** for 2 additional hours.

Acute Ischemic Stroke

0.9 mg/kg (max 90 mg) infused over 60 minutes. Give 10% of the total dose as an initial IV bolus over 1 minute. Give the remaining 90% over the next 60 minutes.

Infusion is always carried out using an infusion pump.

PEDIATRIC DOSAGE:

Not applicable

SUPPLIED FORM(S):

Vial: 50 mg and 100 mg

ADDITIONAL INFORMATION:

1. Generally, reperfusion arrhythmias are only treated if the patient is symptomatic.
2. Patient care responsibilities during Alteplase infusion:
    - Start 2 peripheral IVs in opposite limbs with NS TKVO.
    - Monitor vital signs and neurologic function q 15 minutes x 1 hour, then q 30 minutes for the duration of the infusion.
    - Check IV/venipuncture sites q 30 min x 3 hours.
    - Continuous cardiac monitoring is required (including serial 12 lead ECGs).
    - Ispect all secretions for hemorrhage.
    - Avoid taking BP in the arm with the IV sites or venipuncture (whenever possible).
    - Avoid arterial and venous puncture sites for 36 hours.
3. Reconstitute with sterile water for injection without preservatives. Do not use bacteriostatic water.
4. Slight foaming may occur with reconstitution. Avoid excessive agitation.
5. Do not administer through the same IV as dobutamine, dopamine, heparin or nitroglycerine.

CLASSIFICATION(S):
Bronchodilator; Xanthine

INDICATION(S):
Bronchospasm associated with asthma, chronic bronchitis and emphysema.

THERAPEUTIC ACTION(S):
1. $Beta_2$ stimulation resulting in bronchodilation and venodilation.
2. Relaxes smooth muscle of the bronchi and pulmonary blood vessels.
3. Affects diaphragmatic contractility reducing fatigue and improving contractility in patients with COPD.
4. Respiratory center stimulant.
5. Positive inotropic/chronotropic.
6. Induces diuresis.

ADVERSE EFFECT(S):

CNS
Dizziness, headache, anxiety, tremors, seizures

CVS
Tachycardia, palpitations, dysrhythmias (PVCs), hypotension

GI
N/V

Other
Muscle twitching, hyperglycemia

PRECAUTION(S):
1. For patients on theophylline preparations, reduce loading dose by half if the patient has received a theophylline preparation within past 24 hours.
2. Cardiac, hepatic, or renal insufficiency.
3. CHF, acute pulmonary edema.
4. Sepsis.

CONTRAINDICATION(S):

1. Hypersensitivity to xanthine derivatives (caffeine, theophylline) or ethylenediamine.
2. Dysrhythmias (PVCs, tachycardia).
3. Hypotension.
4. Underlying seizure disorders.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

Loading

6 mg/kg in 50 – 100 mL D_5W or NS over 20-30 minutes. Do not exceed 25 mg/minute.

Maintenance

0.3 – 1 mg/kg/hr

PEDIATRIC DOSAGE:

Same as adult.

SUPPLIED FORM(S):

Ampule: 500 mg/10mL (50 mg/mL), 250 mg/10mL (25 mg/mL)

ADDITIONAL INFORMATION:

1. Draw blood prior to administration if possible.
2. Therapeutic to toxic ratio is narrow (no longer recommended for routine use).
3. Beta blockers oppose effects.
4. Rapid administration may cause severe hypotension or cardiac arrest (with more than 25 mg/min).
5. Alcohol, propranolol, verapamil and certain antibiotics decrease *elimination*.
6. Aminophylline can be used to reverse the adenosine mediated adverse effects of dipyridamole.

amiodarone **Cordarone, Pacerone**

CLASSIFICATION(S):
Antidysrhythmic

INDICATION(S):
1. Treatment of shock-refractory VF/pulseless VT.
2. Polymorphic VT and wide complex tachycardia of uncertain origin.
3. Control of hemodynamically stable VT.
4. Use as adjunct for chemical cardioversion of SVT, PSVT.
5. Termination of ectopic or multifocal atrial tachycardia with preserved LV function.
6. Rate control in treatment of A-fib/A-flutter when other therapies are ineffective.

THERAPEUTIC ACTION(S):
1. Prolongs the cardiac action potential and refractory period in all cardiac tissues including the sinus node, atrium, AV node and ventricles without significantly affecting the membrane potential.
2. Inhibits alpha and beta-adrenergic stimulation resulting in relaxation of vascular smooth muscle and decreases peripheral vascular resistance.
3. Possesses characteristics of all four antidysrhythmic classes and prolongs the refractory period by:
    - Class I – Blocks sodium channels.
    - Class II – Inhibits sympathetic stimulation (non-competitive beta blocker).
    - Class III – Blocks potassium channel.
    - Class IV – Blocks calcium channels.
4. Increases the VF threshold.
5. Negative chronotropic and inotropic.
6. Slows conduction through the AV node.
7. Increases PR & QT intervals.
8. Decreases sinus node and junctional automaticity.

ADVERSE EFFECT(S):

CNS
Malaise, fatigue, tremor, dizziness

CVS
Bradycardia, AV block, cardiac arrest, hypotension, prolonged QT

GI
N/V, abdominal pain

PRECAUTION(S):

1. May produce hypotension by decreasing peripheral vascular resistance (afterload).
2. Observe for bradycardia.
3. When given with digitalis preparations, amiodarone may cause digitalis toxicity.
4. May potentiate effects of some anticoagulants.
5. May prolong Q-T interval especially in combination with procainamide, quinidine or tricyclic antidepressants (torsades des pointes).
6. Discontinue use of other antidysrhythmics when administering amiodarone.
7. Hepatic or renal function impairment.
8. Hypokalemia, hypomagnesemia.
9. Elderly.
10. Pulmonary disease.

CONTRAINDICATION(S):

1. Hypersensitivity or known iodine hypersensitivity (iodine makes up a large part of the amiodarone molecule).
2. Bradycardia (may induce or exacerbate higher levels of heart block).
3. Sinus node dysfunction.
4. Second and third degree heart blocks.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

V-Fib/Pulseless V-Tach

300 mg (diluted with 20 mL NS) IVP. If VF/pulseless VT recurs, consider administration of a second dose of 150 mg.

VT/WCT (Stable)

150 mg over 10 minutes (15 mg/min), repeat infusion q 10 minutes as needed. Max cumulative dose 2.2 grams over 24 hours.

Infusion prepared by adding 150 mg in 50 mL NS, infuse at 300 mL/hour or 300 gtts/minute (60 drop set).

Maintenance Infusion

1 mg/minute over 6 hours

Infusion prepared by adding 150 mg in 250 ml NS, infuse at 100 mL/hour or 100 gtts/minutes (60 drop set).

PEDIATRIC DOSAGE:

V-Fib/Pulseless V-Tach

5 mg/kg (max 300 mg) diluted in 5 mL NS rapid IV/IO push.

PSVT/Wide Complex Tachyarrhythmias

5 mg/kg (max 150 mg) IV/IO over 20-60 minutes, repeat to a max of 15 mg/kg/24 hours.

Infusion prepared by adding the desired dose to 50 mL NS infused at 100 mL/hour (infusion pump), 100 gtts/minute (60 drop set).

SUPPLIED FORM(S):

Ampules: 50 mg/mL, 3 and 6 mL

ADDITIONAL INFORMATION:

1. Do not administer through the same line as sodium bicarbonate.
2. Increased toxicity with procainamide.
3. Protect from light during storage.
4. Increased hypotension, bradycardia and decreased cardiac output with fentanyl.
5. Data limited in pediatrics. Avoid use in neonates.
6. Increases plasma concentrations of digitalis and phenytoin.
7. A number of cases of refractory drug-induced ventricular tachycardia or fibrillation have been reported to respond to amiodarone. Use with caution because data is limited and amiodarone may worsen drug-induced hypotension and may also have proarrhythmic effects. Again, use with caution, if at all.

atenolol **Tenormin**

CLASSIFICATION(S):
Beta–Adrenergic Receptor Blocking Agent

INDICATION(S):
1. To reduce $Beta_1$ effects in acute myocardial infarction (decreases myocardial workload and oxygen demand).
2. Rate control in SVT, PSVT, A-Fib and A-Flutter.
3. Unstable angina.
4. Emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

THERAPEUTIC ACTION(S):
1. $Beta_1$ receptor blockade results in a negative chronotropic, inotropic and dromotropic response. The end result is a decrease in myocardial oxygen consumption and workload.
2. Blocks the agonistic effects of the sympathetic neurotransmitters by competing for receptor binding sites.
3. Inhibits $Beta_2$ receptors at higher doses.

ADVERSE EFFECT(S):

CNS
Fatigue, dizziness, headache, lightheadedness

RESP
Bronchospasm, dyspnea

CVS
Bradycardia, second and third degree blocks, hypotension, CHF

GI
N/V

PRECAUTION(S):
1. Beta blocker use in diabetic and shock patients may mask catecholamine induced signs as well as symptoms of acute hypoglycemia and hypovolemia.
2. May impair recovery from hypoglycemia in diabetics because it blocks the effects of catecholamines that promote glycogenolysis and mobilize glucose in response to hypoglycemia.
3. Liver and renal insufficiency.

4. Administration of epinephrine for allergic and anaphylactic reactions in patients taking beta blockers may result in a hypertensive crisis. In this case the beta effects of epinephrine are blocked allowing the vasoconstrictive alpha properties to take effect.
5. Geriatric patients may be extremely sensitive to a drop in HR and BP.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Sinus bradycardia, sick sinus syndrome, second and third degree heart blocks.
3. Right ventricular failure secondary to pulmonary hypertension.
4. Cardiogenic shock.
5. Severe left ventricular failure (CHF).
6. Bronchospastic disease (asthma, COPD, emphysema, chronic bronchitis).
7. MI patients:
    - HR < 60 beats/minute
    - Heart blocks > first degree
    - Systolic BP < 100 mmHg
8. Concomitant use of calcium channel blockers (wait several hours), including patients on oral calcium channel blockers (may cause severe hypotension).
9. Drug-induced tachycardia (especially with cocaine).
10. Drug-induced hypertension.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

5 mg slow IV (over 5 minutes) wait 10 minutes, then give a second dose of **5 mg**

PEDIATRIC DOSAGE:

Not applicable.

SUPPLIED FORM(S):

Vial: 1 or 10 mL (0.5 mg/ml)

ADDITIONAL INFORMATION:

1. Monitor all vital signs frequently - ECG and clinical response.
2. Avoid HR < 60 beats/minute, BP < 100 mmHg.
3. Best results seen if the drug is given within two hours of the onset of signs and symptoms of AMI.

4. Concurrent administration with amiodarone may result in additive depressant effects on conduction, as well as negative inotropic effects.
5. In drug-induced hypertension, beta blockers may only block beta receptors, leaving unopposed alpha-adrenergic stimulation and worsening hypertension. Hypertension is often short-lived so aggressive therapy for drug-induced hypertensive emergencies is rarely needed and may contribute to worsening hypotension, after the hypertension resolves. Benzodiazepines are the first drugs of choice for the treatment of sympathomimetic OD (i.e., an overdose of cocaine).
6. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.

atropine

CLASSIFICATION(S):
Parasympatholytic–Vagal Blocker; Anticholinergic

INDICATION(S):
1. Symptomatic bradycardia.
2. Asystole/PEA.
3. AV blocks at the nodal level.
4. Preintubation/RSI (especially in children).
5. In conjunction with neostigmine, it reverses the effects of nondepolarizing neuromuscular blocking agents.
6. Organophosphate poisoning.

THERAPEUTIC ACTION(S):
1. Inhibits the muscarinic actions of acetylcholine on structures innervated by postganglionic cholinergic nerves as well as on smooth muscles that respond to acetylcholine but lack cholinergic innervation. These postganglionic receptor sites are present in the autonomic effector cells of smooth muscle, cardiac muscle, sinoatrial and atrioventricular nodes, and exocrine glands.
2. Atropine antagonizes the actions of cholinesterase inhibitors at muscarinic receptor sites including increased tracheobronchial and salivary secretion, bronchoconstriction, autonomic ganglionic stimulation and to a moderate extent, central actions.
3. Increases SA node discharge and increases conduction through the AV node, causing a positive chronotropic and positive dromotropic effect.
4. Anticholinergic (decreases body secretions).
5. Potent bronchodilator (transient).

ADVERSE EFFECT(S):
CVS
Tachycardia, palpitations, increases myocardial O_2 demand leading to PVCs, VT, VF

Anticholinergic
Pupil dilation, dry mouth, blurred vision, fever, flushed/hot dry skin and photophobia

PRECAUTION(S):
1. Paradoxical bradycardia if adult dose less than 0.5 mg or given to slow.
2. Is not effective with infranodal blocks (second degree block type II or third degree block with a new wide QRS complex). It is thought that at this level, atropine rarely accelerates the atrial rate and often produces increased AV nodal blockades. An increased AV block is often accompanied by a decrease in the ventricular rate and blood pressure. Be prepared to pace or initiate catecholamine infusion.

3. Hepatic or renal insufficiency.
4. Myocardial ischemia and hypoxia.
5. Hypertension.
6. COPD (reduction in bronchial secretion can lead to formation of bronchial mucous plugs), hypoxia or cyanosis.
7. Pregnancy (may cause fetal tachycardia).

CONTRAINDICATION(S):

1. Uncorrected tachydysrhythmias.
2. Hypothermic bradycardia.

ROUTE(S) OF ADMINISTRATION:

IV; ETT

ADULT DOSAGE:

Bradycardia

0.5 – 1 mg IV push q 3-5 minutes prn; max 0.03-0.04 mg/kg or 2-3 mg

Asystole/PEA

1 mg IV push q 3-5 minutes prn; max 0.04 mg/kg or 3 mg in asystole or if the patient displays an absolute bradycardia within a PEA.

Organophosphate Poisoning (resulting in cholinergic stimulation)

2 mg IV push q 5 minutes prn until decrease in **SLUDGE**:

Salivation, **L**acrimation, **U**rination, **D**efecation, **G**astrointestinal cramping, **E**mesis

PEDIATRIC DOSAGE:

0.02 mg/kg; minimum dose is 0.1 mg; maximum single dose is 0.5 mg in children and 1.0 mg in adolescents

SUPPLIED FORM(S):

Preload: 1 mg/10 mL (0.1 mg/mL)

Ampule: 0.4 mg/mL & 0.6 mg/mL

ADDITIONAL INFORMATION:

1. 3 mg or 0.04 mg/kg generally results in full vagal blockade.
2. Denervated transplanted hearts will not respond to atropine.

CLASSIFICATION(S):
Antiparkinsonian Agent; Anticholinergic, Antidyskinetic

INDICATION(S):
1. Treatment of acute dystonic reactions that may appear during treatment with phenothiazine derivatives and butyrophenones (chlorpromazine, haloperidol and droperidol).
2. Treatment of all forms of Parkinson's disease (impairment of muscular tone).

THERAPEUTIC ACTION(S):
Partially blocks central (striatal) cholinergic receptors thereby helping to balance cholinergic and dopaminergic activity in the basal ganglia; salavation may be decreased, and smooth muscle may be relaxed.

ADVERSE EFFECT(S):

CNS
Nervousness, confusion, numbness/tingling

CVS
Tachycardia, dysrhythmias

Anticholinergic
Dry mouth, blurred vision, mydriasis

GI
N/V

PRECAUTION(S):
1. Use with caution in patients with cardiovascular disease.
2. May enhance the CNS depressant effects of alcohol, anticonvulsants, barbiturates, MAO inhibitors, narcotics, TCAs and phenothiazines.

CONTRAINDICATION(S):
1. Narrow angle glaucoma (due to atropine like side effects).
2. Hypersensitivity.
3. Hepatic/renal function impairment.
4. Myasthenia gravis.

ROUTE(S) OF ADMINISTRATION:
IV; IM; PO

Note: No significant difference in the onset of effects are seen after IV or IM injections. Therefore, in acute dystonic reactions the IM route is just as effective with a noticeable improvement seen within a few minutes after the injection.

ADULT DOSAGE:
1-4 mg IV/IM prn, max 6 mg/day.

Generally **2 mg** IV or IM will quickly relieve the condition.

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
2 mL ampule (1 mg/mL)

ADDITIONAL INFORMATION:
An acute dystonic reaction has characteristic signs of Parkinsonian symptoms:

- Tremors of resting muscles.
- Inappropriate postures of the neck, trunk and limbs.
- Slowing of voluntary movement.
- Loss of mobility in the face.

calcium chloride

CLASSIFICATION(S):
Electrolyte

INDICATION(S):
1. Calcium channel blocker overdose.
2. Known or suspected hyperkalemia.
3. Hypocalcemia.
4. Hypermagnesemia.
5. Beta blocker overdose secondary to glucagon, atropine, pacing and dopamine.

THERAPEUTIC ACTION(S):
1. Calcium is an essential element needed for the functional integrity of the nervous and muscular systems. It plays a role in normal cardiac function, renal function, respiration, blood coagulation, and all cell membrane and capillary permeability. Also, calcium helps to regulate the release and storage of neurotransmitters and hormones.
2. Positive inotropic.
3. Enhances automaticity.
4. May stabilize myocardial contractility in the hyperkalemic patient (K^+ level > 6 mEq/L) and reverse ECG changes without changing serum K^+ levels.

ADVERSE EFFECT(S):

CNS
Tingling, syncope

CVS
Hypotension, bradycardia (influx into cell, prolonging refractory period), dysrhythmias (asystole, VF) vasospasms of cerebral and coronary arteries, and peripheral vasodilation

Other
Warmth, pain, burning or phlebitis extending from the IV site.

PRECAUTION(S):
1. Extravasation causes tissue necrosis.
2. Cardiovascular/cerebrovascular disease (potential for arterial vasospasm).
3. Impaired renal function.
4. Calcium infused with sodium bicarbonate causes a precipitate to form.

CONTRAINDICATION(S):
1. Digitalis toxicity (increased risk of arrhythmias).

2. Hypercalcemia.
3. Rarely indicated for drug-induced tachycardia.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:

Symptomatic Hyperkalemia and Calcium Channel Blocker Overdose:
8 – 16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose, repeat q 10–20 minutes prn to a max total of 3 grams

Infusion prepared by adding the desired dose to 50 mL NS infused at 150 mL/hr.
There is little evidence to support the *efficacy* of doses greater than one gram in the treatment of calcium channel blocker overdose.

Prophylaxis of Calcium Channel Blocker Overdose/ Before IV calcium channel blockers
2 – 4 mg/kg slow IV at < 100 mg/minute, repeat q 10–20 minutes prn; max 1 gram.

PEDIATRIC DOSAGE:
20 mg/kg slow IV push over 5-10 minutes.

Infusion prepared by adding the desired dose to 50 mL NS infused at 150 mL/hour (infusion pump), 150 gtts/minute (60 drop set).

SUPPLIED FORM(S):
Preload: 1 g/10 mL (100 mg/mL) 10% solution

ADDITIONAL INFORMATION:
1. Maintain a high index of suspicion in patients with known renal failure who present in cardiac arrest, even if potassium levels are not available or are unknown.
2. Will potentiate the effects of digitalis.
3. Hypocalcemia may be evidenced by a long QT interval; T wave flattening or inversion.
4. Hypercalcemia may be evidenced by a short QT interval; QRS may be prolonged.
5. If possible keep patient supine for 30-60 minutes after IV injection.
6. Rapid infusion may cause bradycardia.
7. Calcium chloride is the preferred calcium salt vs. calcium gluconate, as it produces consistently higher and more predictable levels of ionized calcium in plasma.

8. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication aids in the antagonism of the toxic effects of hyperkalemia at the cell membrane, redistribution/intracellular shift of K^+ into cells, and elimination of excess K^+. The dosages are as follows:
    - Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose
    - Sodium Bicarbonate – 1 mEq/kg q 15 min
    - Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV
    - Nebulized ventolin – 10-20 mg over 15 min prn
    - Lasix – 40-80 mg slow IV push
9. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    - 5.5 to < 6 – peaking (tenting) of T waves
    - 6 to < 6.5 – increasing PR and QT intervals
    - 6.5 to < 7 – flattened P waves and ST segments
    - 7 to < 7.5 – widened QRS complexes
    - 7.5 to < 8 – deepening S waves, merging of S and T waves
    - 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance
    - 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole

cefazolin **Kefzol; Ancef; Zolicef**

CLASSIFICATION(S):
Antibiotic; Cephalosporin

INDICATION(S):
Open fractures (to prevent osteomyelitis).

THERAPEUTIC ACTION(S):
A cephalosporin antibiotic that exerts its bacterial action through inhibition of bacterial cell wall synthesis, causing cell death.

ADVERSE EFFECT(S):

CNS
Seizures (high doses)

CVS
Anaphylaxis

GI
N/V, ABD pain

PRECAUTION(S):
1. GI disease.
2. Hepatic/renal function impairment.
3. Bleeding disorders.
4. Allergy to penicillin.
5. Convulsive disorders.

CONTRAINDICATION(S):
Hypersensitivity to cephalosporin group of antibiotics.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
1 g slow IV over 5-15 minutes/IM q 6-8 hours, max 12 g/day

PEDIATRIC DOSAGE:
25 mg/kg slow IV over 5-15 minutes/IM q 6-8 hours, max 6 g/day

SUPPLIED FORM(S):
500 mg or 1 g vial in a powder form

ADDITIONAL INFORMATION:
1. Dilute powder form with 10 mL N/S and add to 50-100 mL NS.
2. If giving IM, dilute with 3 mL NS.
3. Give IM into a large muscle mass.
4. Cefazolin has many indicated uses including bone and joint infections, UTI's, meningitis, pneumonia, skin and soft tissue infections to name a few. The use of cefazolin in these settings should only be based with in-hospital assessments or after consulting a physician.

chlorpromazine **Largactil**

CLASSIFICATION(S):
Antipsychotic

INDICATION(S):
1. Treatment of acute psychotic episodes.
2. Management of aggressive and agitated behavior.

THERAPEUTIC ACTION(S):
1. Blocks postsynaptic dopamine D_2 receptors in the mesolimbic area of the brain and by producing alpha-adrenergic blockade.
2. Onset of action is 1-2 hours after IM injection and is maintained for an average of 6 hours.

ADVERSE EFFECT(S):

CNS
Extrapyramidal symptoms, seizures, headache

RESP
Respiratory depression

CVS
Hypotension, tachycardia, cardiac arrest

GI
Dry mouth, N/V, anorexia, constipation

Skin
Rash

PRECAUTION(S):
1. Use with caution in patients with seizure disorders (may lower the seizure threshold).
2. Elderly (reduce dose).
3. Hepatic/renal function impairment.
4. May cause QT prolongation.
5. Cardiovascular disease.

CONTRAINDICATION(S):

1. Hypersensitivity to chlorpromazine, phenothiazines, or sulfites.
2. CNS depression or patients taking other CNS depressants.
3. Congenital long QT syndrome or history of cardiac arrhythmias.
4. Hypotension.
5. Parkinson's disease.

ROUTE(S) OF ADMINISTRATION:

IM

ADULT DOSAGE:

25 – 100 mg q 4 – 6 hrs prn, max 400 mg/day

PEDIATRIC DOSAGE:

0.5-1.0 mg/kg q 4-6 hrs, max 40 mg/day

SUPPLIED FORM(S):

Ampule: 25 mg/mL, 2 mL ampule

ADDITIONAL INFORMATION:

1. Monitor vital signs frequently.
2. Use benztropine or diphenhydramine to combat extrapyramidal symptoms should they occur.

cimetidine **Tagamet**

CLASSIFICATION(S):
Histamine H_2 antagonist

INDICATION(S):
1. Treatment of duodenal and gastric ulcers.
2. Gastroesophageal reflux disease.
3. Management of upper gastrointestinal hemorrhage where inhibition of gastric acid secretion is beneficial.

THERAPEUTIC ACTION(S):
1. Competitively inhibits the action of histamine at histamine H_2 receptor sites of the gastric parietal cells (responsible for production of hydrochloric acid). The end result is inhibition of gastric acid secretion.
2. Inhibits gastric secretion stimulated by food, caffeine, insulin, and physiological vagal reflex.
3. Inhibits secretions caused by histamine.

ADVERSE EFFECT(S):

CNS
Confusion, headache, dizziness, fatigue

RESP
Bronchospasm

CVS
Dysrhythmias, hypotension (IV use)

GI
Diarrhea, N/V

Skin
Rashes

PRECAUTION(S):
1. Renal insufficiency.
2. Cimetidine may reduce hepatic metabolism of warfarin anticoagulants, phenytoin, beta blockers, lidocaine, diazepam, theophylline and calcium channel blockers which will result in an elevation of drug blood levels for all agents. Therefore, one must consider decreasing the dosage of all of the above agents.

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
PO; IV

ADULT DOSAGE:
300 mg in 50 – 100 mL IV minibag of D_5W or NS infused over 15 minutes q 6 hrs max 2400 mg/24 hours

PEDIATRIC DOSAGE:
20-40 mg/kg/day

SUPPLIED FORM(S):
Vial: 300 mg/2 mL (150 mg/mL)

ADDITIONAL INFORMATION:
Smoking decreases cimetidine's effectiveness.

clopidogrel **Plavix**

CLASSIFICATION(S):
Antithrombotic; Platelet Aggregation Inhibitor

INDICATION(S):
1. Reduction of atherosclerotic events (AMI, stroke, vascular death) in patients with a history of symptomatic atherosclerotic disease.
2. Alternative to aspirin for patients with aspirin sensitivity, intolerance, or when aspirin produces a poor response.

THERAPEUTIC ACTION(S):
1. Inhibits adenosine diphosphate (ADP) binding to its platelet receptor and subsequent ADP-mediated activation of the glycoprotein GP IIb/IIIa complex, thus inhibiting platelet aggregation. Because clopidogrel irreversibly modifies the ADP receptor, platelets are affected for the remainder of their lifespan (approximately seven days).
2. *Biotransformation* is necessary to produce inhibition of platelet aggregation.

ADVERSE EFFECT(S):

CNS
Headache, dizziness, weakness, fatigue, depression

RESP
Dyspnea, coughing

CVS
Chest pain, edema, hypertension

GI
GI hemorrhage, diarrhea, N/V, ulcers

Skin
Rash

PRECAUTION(S):
1. Hepatic function impairment.
2. Recent trauma or surgery.
3. Patients receiving anticoagulant therapy (i.e. Warfarin).
4. Patients already taking aspirin or NSAIDS (may increase risk of gastrointestinal hemorrhage).

clopidogrel **Plavix**

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Active ulcer disease (active GI hemorrhage).
3. Coagulation or platelet function disorders.
4. Active pathological bleeding.

ROUTE(S) OF ADMINISTRATION:
PO

ADULT DOSAGE:
75 mg oral tablet once/day

PEDIATRIC DOSAGE:
Not recommended

SUPPLIED FORM(S):
75 mg tablets

ADDITIONAL INFORMATION:
Studies have shown clopidogrel to be as equally beneficial as ASA and in certain cases, it helped to lower risk factors.

codeine

CLASSIFICATION(S):
Narcotic (opiate); Analgesic

INDICATION(S):
Alone or in combination with non-narcotic analgesics for the treatment of mild to moderate pain.

THERAPEUTIC ACTION(S):
1. Binds to various opiate receptors producing analgesia and sedation.
2. Depresses the cough reflex (antitussive).

ADVERSE EFFECT(S):

CNS
Sedation

RESP
Respiratory depression

CVS
Hypotension, bradycardia

GI
N/V, constipation

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. Pain of unknown etiology.
3. Multiple trauma.
4. Concomitant use of CNS depressant drugs or medications.
5. Head injury/increased ICP.
6. Elderly patients.
7. Gallbladder disease or gallstones (may cause biliary contraction).

CONTRAINDICATION(S):
1. Hypotension (below 100 systolic).
2. Respiratory depression.
3. Acute exacerbation of asthma or COPD.
4. Hypersensitivity.

codeine

ROUTE(S) OF ADMINISTRATION:
PO; SC; IM

ADULT DOSAGE:
15 – 60 mg q 4 hrs prn

PEDIATRIC DOSAGE:
0.5-1 mg/kg PO or IM, q 4-6 hours, max 60 mg/dose

SUPPLIED FORM(S):
Tablet: 15 mg or 30 mg
Ampule: 30 mg/mL or 60 mg/mL

ADDITIONAL INFORMATION:

1. Have naloxone and resuscitation equipment available.
2. Parenteral codeine can be given with an antiemetic.
3. Available in combination with non-narcotic analgesics (acetylsalicylic acid & acetaminophen).
    - 222 – 8 mg codeine + 325 mg ASA
    - 282 – 15 mg codeine + 325 mg ASA
    - 292 – 30 mg codeine + 325 mg ASA
    - Tylenol # 1 – 8 mg codeine + 325 mg acetaminophen
    - Tylenol # 2 – 15 mg codeine + 325 mg acetaminophen
    - Tylenol # 3 – 30 mg codeine + 325 mg acetaminophen
    - Tylenol # 4 – 60 mg codeine + 325 mg acetaminophen

dexamethasone **Decadron; Hexadrol**

CLASSIFICATION(S):
Corticosteroid

INDICATION(S):
1. Anaphylaxis/allergic reactions.
2. Acute exacerbation of asthma/COPD.
3. Cerebral edema (controversial).
4. Croup.

THERAPEUTIC ACTION(S):
1. Corticosteroids diffuse across cell membranes and comp with specific cytoplasmic receptors. These complexes then enter the cell nucleus, bind to DNA, and stimulate transcription of messenger RNA (mRNA) and subsequent protein synthesis of various enzymes thought to be ultimately responsible for two categories of effects of systemic corticosteroids (anti-inflammatory, and immunosuppressant).
2. Decreases or prevents tissue responses to inflammatory processes, thereby reducing development of symptoms of inflammation without affecting the underlying cause.
3. Inhibits accumulation of inflammatory cells, including macrophages and leukocytes, lysosomal enzyme release, and synthesis and/or release of several chemical mediators of inflammation.
4. Reduction of cerebral edema (mechanism unknown).

ADVERSE EFFECT(S):
There are no significant side effects associated with a single dose when utilized in emergencies. Most adverse effects are seen over long-term use:

CNS
Convulsions, headache, vertigo

CVS
CHF, hypertension

GI
GI hemorrhage, nausea, abdominal distension

Fluid & Electrolyte
Sodium & water retention, hypokalemia

Other
Impaired wound healing

PRECAUTION(S):

1. AMI, CHF.
2. Hypertension.
3. Diabetes mellitus.
4. Sulfite allergy.
5. Convulsive disorders.

CONTRAINDICATION(S):

None when used in an emergency setting.

ROUTE(S) OF ADMINISTRATION:

IV; IM; PO

ADULT DOSAGE:

4 – 20 mg slow IV push/IM (10-12 mg dosage is the most common).

PEDIATRIC DOSAGE:

0.5-1 mg/kg

SUPPLIED FORM(S):

Vial: 4 mg/mL, 5 mL vial

ADDITIONAL INFORMATION:

1. Onset of action is 2 – 6 hours.
2. Patients (pediatrics) recently having been exposed to chicken pox or those who currently have the disease should not receive any steroids, as the administration of steroids in this setting may alter the immune response and result in severe disease or death.
3. Do not administer through the same line as midazolam.
4. Epinephrine is the drug of choice in anaphylaxis.

dextrose 50% **$D_{50}W$**

CLASSIFICATION(S):
Carbohydrate; Hyperglycemic; Hypertonic solution of 50% dextrose in H_2O

INDICATION(S):
To increase blood glucose levels in situations of hypoglycemia.

THERAPEUTIC ACTION(S):
1. Increases blood glucose levels.
2. Hypertonic solution producing a transient movement of water from interstitial spaces into the venous system (osmotic diuretic).

ADVERSE EFFECT(S):

CVS
Phlebitis, pulmonary edema, fluid overload

Other
Rebound hyperglycemia, tissue necrosis

PRECAUTION(S):
1. Tissue necrosis if infiltration occurs, give half of total volume and check IV patency.
2. May precipitate severe neurologic symptoms in alcoholics (give thiamine prior to $D_{50}W$).
3. Intracranial hemorrhage, stroke (unless documented hypoglycemia).

CONTRAINDICATION(S):
Hyperglycemia.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
25 g $D_{50}W$ (50 mL) IV push, repeat prn

PEDIATRIC DOSAGE:
Neonates
0.2 g/kg $D_{10}W$ (2 mL/kg)

Prepare $D_{10}W$ by diluting $D_{50}W$ to a 4:1 ratio (remove 40 mL from the amp and draw up 40 mL NS)

dextrose 50% **$D_{50}W$**

Infant/Child

0.5 – 1.0 g/kg $D_{25}W$ (2-4 mL/kg)

Prepare $D_{25}W$ by diluting $D_{50}W$ to a 1:1 ratio (remove 25 mL from the amp and draw up 25 mL NS)

SUPPLIED FORM(S):

Preload: 25 g/50 mL (500 mg/mL)

ADDITIONAL INFORMATION:

1. Utilize a large bore catheter in a large vein.
2. $D_{50}W$ has a short duration of action, therefore follow drug administration with an oral complex carbohydrate.
3. Max rate at which dextrose can be infused without producing glycosuria is 0.5 g/kg/hr.
4. Severe thiamine deficiency can reduce glucose utilization by half and may precipitate Wernicke's encephalopathy or Korsakoff's syndrome.
5. Wernicke's encephalopathy is an acute and irreversible disorder associated with chronic alcoholism. It is characterized by poor voluntary muscle coordination, eye muscle weakness and mental derangement.
6. Korsakoff's syndrome is a frequent result of chronic alcoholism. It is characterized by disorientation, illusions, hallucinations and painful extremities.
7. Increased intracellular glucose levels in the setting of cerebral ischemia and hypoxia result in increased intracellular acidosis due to anaerobic metabolism of glucose and subsequent neuronal death.
8. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication aids in the antagonism of the toxic effects of hyperkalemia at the cell membrane, redistribution/intracellular shift of K^+ into cells, and elimination of excess K^+. The dosages are as follows:
    a. Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose
    b. Sodium Bicarbonate – 1 mEq/kg q 15 min
    c. Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV
    d. Nebulized ventolin – 10-20 mg over 15 min prn
    e. Lasix – 40-80 mg slow IV push
9. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    a. 5.5 to < 6 – peaking (tenting) of T waves
    b. 6 to < 6.5 – increasing PR and QT intervals
    c. 6.5 to < 7 – flattened P waves and ST segments

d. 7 to < 7.5 – widened QRS complexes

e. 7.5 to < 8 – deepening S waves, merging of S and T waves

f. 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance

g. 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole

diazepam **Valium**

CLASSIFICATION(S):
Anticonvulsant; Sedative/hypnotic; Skeletal muscle relaxant

INDICATION(S):
1. Anticonvulsant therapy in status epilepticus.
2. Sedation.
3. Short term relief of anxiety disorders.
4. Muscle spasms.
5. Acute alcohol withdrawal including delirium tremens.
6. Cocaine overdose.

THERAPEUTIC ACTION(S):
1. Reduces the ability of the neuron to depolarize to the threshold required to produce an action potential. Thus, the seizure threshold is raised.
2. Suppresses the spread of seizure activity produced by epileptogenic foci in the cortex, thalamus and limbic structures but does not abolish the abnormal discharge of the focus.
3. Potentiates gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter. Activation of the GABA receptor results in the opening of the chloride channel, allowing the flow of chloride ions into the neuron. This results in hyperpolarization, which inhibits firing of the neuron and translates into decreased neuronal excitability, thus attenuating the effects of subsequent depolarizing excitatory transmitters.
4. Decreases seizure activity by enhanced presynaptic inhibition.
5. Produces skeletal muscle relaxation primarily by inhibiting spinal polysynaptic afferent pathways. May also directly depress motor nerves and muscle function.
6. CNS depressant.
7. Muscle relaxant.

ADVERSE EFFECT(S):

CNS
Sedation, drowsiness, confusion, transient amnesia

RESP
Respiratory depression

CVS
Hypotension, bradycardia

GI
N/V

PRECAUTION(S):

1. Use with caution in elderly.
2. Compromised respiratory status.
3. Concomitant use of CNS depressant drugs or medications.

CONTRAINDICATION(S):

Hypoglycemic seizures (use $D_{50}W$).

ROUTE(S) OF ADMINISTRATION:

IV; IM; PR

ADULT DOSAGE:

Seizures & Sedation

5-10 mg slow IV push (do not exceed 5 mg/minute), repeat q 5-15 minutes prn; max 20 mg

Cocaine Overdose

5 mg slow IV push titrated to effect

PEDIATRIC DOSAGE:

0.1 – 0.3 mg/kg IV/IM q 5 minutes prn
0.5 mg/kg PR

SUPPLIED FORM(S):

Ampule: 10 mg/2 mL (5mg/mL)

ADDITIONAL INFORMATION:

1. Give diazepam in low dosages, as typically these amounts will stop seizure activity. RESP depression is a common adverse effect, especially in pediatrics.
2. Following IM administration, absorption may be slow and erratic (depending on the site of administration), whereas lorazepam is rapid and complete.

CLASSIFICATION(S):
Antihypertensive

INDICATION(S):
Hypertensive crisis where an emergency reduction in diastolic BP is required.

THERAPEUTIC ACTION(S):
1. Relaxes smooth muscle in peripheral arterioles, decreasing peripheral vascular resistance. Cardiac output is increased as blood pressure is reduced; coronary and cerebral blood flow is maintained.
2. Increases blood glucose by inhibiting pancreatic insulin release.
3. Decreases sodium and water excretion.

ADVERSE EFFECT(S):

CNS
TIAs, headache, confusion

CVS
Hypotension, SVT, edema due to sodium & water retention, palpitations

GI
N/V

Other
Hyperglycemia usually requiring treatment in diabetics, rash

PRECAUTION(S):
1. Monitor BP frequently during treatment.
2. Extravasation may result in tissue necrosis.
3. Slow administration may fail to reduce BP or produce only a brief response.
4. Cerebral and cardiac patients with impaired circulation (as a brief drop in BP may be detrimental).
5. Diabetics (may cause acute hyperglycemic episode).
6. Patients prone to sodium and water retention, CHF.
7. Renal impairment.

CONTRAINDICATION(S):

1. Treatment of compensatory hypertension.
2. Hypersensitivity to diazoxide, thiazides or sulfonamides.
3. Dissecting aneurysm.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

1-3 mg/kg IV push over 30 seconds, max 150 mg, repeat q 5-15 minutes until a satisfactory reduction in BP is achieved.

A decrease in BP is usually evident within five minutes.

Injections of > 30 seconds may fail to reduce BP or produce a limited response.

PEDIATRIC DOSAGE:

Limited information.

SUPPLIED FORM(S):

Ampule: 300 mg/20 mL (15 mg/mL)

ADDITIONAL INFORMATION:

1. Often used in combination with a diuretic (furosemide 20-40 mg) to enhance antihypertensive effect and reduce sodium retention.
2. Hypertensive crisis is defined as severe elevation in diastolic BP above 120-130 mmHg with accompanying symptoms. Considered an emergency - if there is evidence of rapid or progressive CNS, myocardial, hematologic or renal deterioration.
3. Patients who are refractory to other antihypertensive agents usually respond to diazoxide.
4. Decreases effectiveness of phenytoin.

diltiazem **Cardizem**

CLASSIFICATION(S):
Calcium Channel Blocker

INDICATION(S):
1. Multifocal atrial tachycardia.
2. Atrial fibrillation/Atrial flutter with RVR.
3. Second line treatment in PSVT after adenosine.

THERAPEUTIC ACTION(S):
1. Diltiazem inhibits calcium ion entry through select voltage-sensitive areas,termed *slow channels* across cell membranes. With the reduction of intracellular calcium concentrations in cardiac and vascular smooth muscle cells - dilation of the coronary arteries, peripheral arteries and arterioles, and decreased vascular resistance result. There may also be a reduction of heart rate, decrease in myocardial contractility (negative inotropic effects), and slowed AV nodal conduction.
2. Increases the refractory period of the AV node.
3. May terminate reentrant dysrhythmias that require AV nodal conduction.

ADVERSE EFFECT(S):

CVS
Hypotension, bradycardia, AV blocks

Other
Flushing

PRECAUTION(S):
1. Left ventricular dysfunction, CHF.
2. Impaired hepatic or renal function.

CONTRAINDICATION(S):
1. A-Fib/A-flutter associated with an accessory bypass tract (WPW, LGL).
2. Sick sinus syndrome (may interfere with sinus-node impulse generation and may induce sinus or sinoatrial block).
3. Hypotension.
4. AV blocks (second and third degree).
5. Wide complex tachycardia of uncertain type.
6. Myocardial infarction.
7. Concomitant use of beta blockers or digitalis (wait several hours), including patients on oral beta blockers (may cause severe hypotension).

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
15-20 mg (0.25 mg/kg) IV over 2 minutes repeat q 15 minutes at **20-25 mg (0.35 mg/kg)** IV over 2 minutes

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Vials: 5 mg/mL, 5 and 10 mL vials

ADDITIONAL INFORMATION:
1. Produces less myocardial depression than verapamil.
2. May increase blood levels of digoxin resulting in toxicity.

digoxin **Lanoxin**

CLASSIFICATION(S):
Cardiac Glycoside; Antidysrhythmic

INDICATION(S):
1. Treatment of atrial fibrillation or flutter with a rapid ventricular response.
2. Paroxysmal atrial tachycardia.

THERAPEUTIC ACTION(S):
1. Positive inotropic: This effect is thought to result from inhibition of movement of sodium and potassium ions across myocardial cell membranes by complexing with adenosine triphosphatase. As a result, there is enhancement of calcium influx and an augmented release of free calcium ions within the myocardial cells to subsequently potentiate the activity of the contractile muscle fibers of the heart. This effect also increases stroke volume and cardiac output.
2. A decrease in the conduction rate (negative dromotropic) and an increase in the effective refractory period of the atrioventricular (AV) node is due predominantly to an indirect effect resulting from enhancement of parasympathetic tone, and possibly from a decrease in sympathetic tone.
3. Negative chronotropic.

ADVERSE EFFECT(S):

CNS
Visual disturbances (blurred or yellow vision), headache, weakness, confusion, seizures

CVS
Dysrhythmias, VT, AV blocks, bradycardia

GI
Anorexia, N/V, diarrhea

PRECAUTION(S):
1. Renal insufficiency, elderly patients (reduce dose).
2. Sinus node dysfunction.
3. Patients who have received digoxin or other digitalis preparations within the past two weeks; reduce dose.
4. Hypokalemia, hypercalcemia and hypomagnesemia predisposes patients to digitalis toxicity.
5. Hypocalcemia decreases the effect of digoxin in patients.
6. AMI or severe pulmonary disease patients tend to be sensitive to digoxin.

7. WPW digoxin enhances impulse transmission through the accessory pathway leading to accelerated ventricular rates and even VF.
8. Incomplete AV blocks may progress to advanced or complete heart blocks.
9. Avoid electrical cardioversion in patients taking digoxin unless the condition is life threatening; use lower energy settings (10-20 J).

CONTRAINDICATION(S):

1. Digitalis toxicity.
2. Hypersensitivity.
3. Heart blocks, sick sinus syndrome.
4. Ventricular tachycardia.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Loading Dose

10 – 15 µg/kg slow IV push over 5 min (**0.5 mg** standard adult loading dose)

Maintenance Dose

0.125-0.5 mg IV

PEDIATRIC DOSAGE:

25 – 40 µg/kg

SUPPLIED FORM(S):

Ampule: 0.5 mg/2 mL (0.25 mg/mL)

ADDITIONAL INFORMATION:

1. Current trends suggest diltiazem (Cardizem) is the drug of choice in atrial fibrillation or flutter with a rapid ventricular response to control rate.
2. Therapeutic levels of digoxin will produce ST segment depression on a 12 lead ECG.
3. Use with a beta blocker may cause severe bradycardia. Amiodarone may increase serum digoxin levels by as much as 100%, and calcium channel blockers may have additive effects on AV nodal conduction that could result in complete heart block.

dihydroergotamine **DHE**

CLASSIFICATION(S):
Sympatholytic

INDICATION(S):
1. Vascular headaches (migraine, cluster headache, histamine cephalalgia).

THERAPEUTIC ACTION(S):
1. Ergot derivatives interact with several neurotransmitter receptors, including alpha-adrenergic, serotonergic and dopaminergic receptors. Both agonistic and antagonistic actions have been reported at different receptor types and subtypes. These medications directly stimulate vascular smooth muscle, causing constriction of both arteries and veins, and depress vasomotor centres in the brain.
2. The constriction of cerebral blood vessels (resulting from alpha-adrenergic stimulation) reduces the pulsation in cerebral arteries that may be responsible for the pain of vascular headaches.
3. The onset of action is highly dependent on the duration of the headache prior to initiation of therapy as well as on the route of administration.
4. Time to peak effect is approximately 15 minutes to two hours.

ADVERSE EFFECT(S):

CNS
Dizziness, confusion

RESP
Shortness of breath

CVS
Precordial pain, tachycardia, bradycardia, hypertension

GI
N/V

Other
Leg weakness, numbness/tingling in fingers and toes, severe vasospasm, itching

PRECAUTION(S):
1. Increase in adverse effects with rapid administration.
2. If given too slowly (longer than 5 minutes), the desired effect will be reduced.

3. Because of high incidents of nausea, premedicate with metoclopramide or prochlorperazine.

CONTRAINDICATION(S):

1. Hypersensitivity to ergot alkaloids.
2. Sepsis.
3. Impaired hepatic or renal function.
4. Peripheral occlusive vascular disease.
5. Peptic ulcer.
6. Cardiovascular disease.
7. Pregnancy/lactation.
8. Severe hypertension.

ROUTE(S) OF ADMINISTRATION:

IV, IV Piggyback, IM, SC

ADULT DOSAGE:

Bolus

0.5-1 mg slow IV push (over 3-5 minutes); IM; SC. Repeat q 30-60 minutes to a max 2 mg IV, 3 mg IM per headache. Max weekly dose 6 mg.

Infusion

1 mg diluted in 50 ml NS infused of 10-15 minutes

1 mg most effective dose for migraine headache

PEDIATRIC DOSAGE:

Not indicated

SUPPLIED FORM(S):

Ampule: 1 mg/1 mL

ADDITIONAL INFORMATION:

1. If an excessive or prolonged dosage is given, watch for peripheral vascular complications.
2. At least 24 hours should elapse before sumatriptan (Imitrex) can be taken following any ergotamine product. Allow at least six hours post Imitrex administration before ergotamine can be administered.

3. If severe vasospasms occur, keep extremities warm. Treatment with vasodilators (nitroprusside, tolazoline) may be required in severe cases.
4. Monitor BP, respirations, signs of chest pain, sever nausea and peripheral vascular complications.

CLASSIFICATION(S):
Antiemetic; Antihistamine

INDICATION(S):
1. Relief or prevention of nausea and vomiting.
2. Relief or prevention of motion sickness.
3. Symptomatic relief of nausea and vomiting associated with Meniere's disease.

THERAPEUTIC ACTION(S):
1. Binds to central muscarinic receptors and produces antiemetic effects.
2. Diminishes vestibular stimulation and depresses labyrinthine function.
3. Sedative effects due to inhibition of histamine N-methyltransferase and blockade of central histaminergic receptors.
4. Central inhibition of the actions of acetylcholine, which are mediated via muscarinic receptors (anticholinergic action).
5. Similar chemical composition to that of diphenhydramine.
6. H_1 receptor antagonist.

ADVERSE EFFECT(S):

CNS
Drowsiness, headache, blurred vision

RESP
Thickened bronchial secretions

CVS
Hypotension, palpitations

Other
Dry mouth/throat

PRECAUTION(S):
1. Asthmatic attack.
2. Pneumonia.
3. Dilute with NS prior to IV administration to avoid vein irritation.
4. Hx of seizure disorders.
5. Increased intraocular pressure/acute narrow angle glaucoma.

CONTRAINDICATION(S):
Nothing significant.

ROUTE(S) OF ADMINISTRATION:
IM; IV

ADULT DOSAGE:
50 – 100 mg IM q 4 hrs prn

1 mg/kg slow IV push (max 50 mg) q 4 hrs prn (25-50 mg IV most common dose)

PEDIATRIC DOSAGE:
1 mg/kg slow IV push or IM, max 25 mg

SUPPLIED FORM(S):
Ampule: 50 mg/mL
Multidose Vial: 250 mg/ 5 mL (50 mg/mL)

ADDITIONAL INFORMATION:
1. Meniere's disease is a disorder of the labyrinth of the inner ear. igns and symptoms include vertigo, severe N/V and nystagmus (involuntary, rapid, rhythmic movement of the eyeball).
2. A paradoxical reaction characterized by hyperexcitability may occur in children.

diphenhydramine **Benadryl**

CLASSIFICATION(S):
Antihistamine

INDICATION(S):
1. Used following epinephrine in the treatment of anaphylaxis.
2. Allergic reactions.
3. Treatment of acute dystonic (extrapyramidal) reactions that may appear during treatment with phenothiazine derivatives and butyrophenones (chlorpromazine, haloperidol and droperidol).

THERAPEUTIC ACTION(S):
1. Competes with histamine for H_1 receptor sites on effector cells. They thereby prevent, but do not reverse responses mediated by histamine alone.
2. Sedative effects due to inhibition of histamine N-methyltransferase and blockade of central histaminergic receptors.
3. Does not inhibit histamine release.
4. Central inhibition of the actions of acetylcholine, which are mediated via muscarinic receptors (anticholinergic action).

ADVERSE EFFECT(S):

CNS
Drowsiness, dizziness, headache, tremors

RESP
Thickening of bronchial secretions, bronchospasm

CVS
Hypotension, tachycardia, palpitations

GI
Dry mouth, N/V

PRECAUTION(S):
1. Hypotension.
2. Elderly patients.
3. Increased intraocular pressure/acute narrow angle glaucoma.

diphenhydramine **Benadryl**

CONTRAINDICATION(S):

1. Acute asthmatic attack as diphenhydramine possesses anticholinergic properties that thicken bronchial secretions.
2. Subcutaneous injections.

ROUTE(S) OF ADMINISTRATION:

IV; IM; PO

ADULT DOSAGE:

1 mg/kg slow IV push/IM, max 50 mg q 4-6 hours prn

PEDIATRIC DOSAGE:

1 mg/kg slow IV push/IM, max 50 mg q 4-6 hours prn

SUPPLIED FORM(S):

Ampule: 50 mg/mL

ADDITIONAL INFORMATION:

1. The sedative effects of benadryl can be potentiated by the administration of CNS depressants, other antihistamines, narcotics and alcohol.
2. MAO inhibitors will cause an increased and prolonged anticholinergic effect.

dobutamine **Dobutrex**

CLASSIFICATION(S):
Sympathomimetic, Vasopressor

INDICATION(S):
1. Short term inotropic support in the treatment of pulmonary congestion and low cardiac output states resulting from depressed contractility.
2. Short term inotropic support in hypotensive patients with pulmonary congestion and low cardiac output states resulting from depressed contractility. These patients cannot tolerate vasodilators.

Suggested for systolic blood pressures between 70-100 mmHg, and no signs of shock.

THERAPEUTIC ACTION(S):
1. Dobutamine is a direct-acting inotropic agent that acts primarily on $beta_1$ adrenergic receptors, with little effect on $beta_2$ or alpha receptors. Dobutamine directly stimulates $beta_1$ receptors of the heart to increase myocardial contractility and stroke volume, resulting in increased cardiac output. Coronary blood flow and myocardial oxygen consumption are usually increased because of increased myocardial contractility. Dobutamine has little effect on systemic vascular resistance and systolic blood pressure. Pulse pressure may remain unchanged or be increased because of increased cardiac output.
2. Reduces elevated ventricular filling pressure (preload reduction) and facilitates atrioventricular (AV) node conduction.

ADVERSE EFFECT(S):

CNS
Headache

CVS
Tachycardia, dysrhythmias (PVCs), hypertension, chest pain due to myocardial ischemia produced by tachycardia

GI
Nausea

PRECAUTION(S):
1. AMI, concern that dobutamine may increase contractile force and heart rate thereby increasing ischemia and potentially infarct size.
2. Sulfite allergy.

3. Recent MI.
4. Infusion pump is mandatory.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Hypovolemia (use fluids first).
3. Uncorrected tachydysrhythmias.
4. Hypertension.
5. May cause hypertensive crisis in patients with pheochromocytoma.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

2-20 µg/kg/minute, start at 2 µg/kg/minute and increase by 2 µg/kg/minute until the desired cardiac output is achieved, max 40 µg/kg/minute.

Avoid

1. An increase in heart rate of more than ten percent from initial value.
2. Presence of ectopic activity.
3. Hypertension.

Mix 500 mg/250 mL D_5W = 2000 ug/mL or
Mix 1000 mg/250 mL D_5W = 4000 ug/mL

PEDIATRIC DOSAGE:

Same as adult.

SUPPLIED FORM(S):

Vial: 250 mg/20 mL

ADDITIONAL INFORMATION:

1. Only effective for a few hours.
2. Monitor BP continuously.
3. When discontinuing, gradually decrease dose.
4. May be ineffective with patients receiving beta blockers.
5. Do not administer through the same line as alteplase, aminophylline, thiopental warfarin, or sodium bicarbonate.
6. In septic patients with decreased systemic vascular resistance, dobutamine may lower blood pressure without increasing cardiac output.

CLASSIFICATION(S):
Sympathomimetic; Vasopressor

INDICATION(S):
1. Hemodynamically significant hypotension in the absence of hypovolemia.
2. Cardiogenic shock associated with AMI and CHF.
3. Symptomatic bradycardia (refractory to atropine).

Suggested for use with systolic blood pressures ≤ 70-100 mmHg with signs of shock.

THERAPEUTIC ACTION(S):
Dopamine stimulates postsynaptic $beta_1$ receptors in the myocardium, mediating its positive inotropic and chronotropic effects. Dopamine causes vascular relaxation and promotes sodium excretion through its stimulation of postsynaptic $dopamine_1$ receptors on vascular smooth muscle and on the kidney. In addition, dopamine stimulates both $alpha_1$ and $alpha_2$ receptors, which mediate smooth muscle vasoconstriction. These pharmacologic effects are dose dependant, requiring various infusion rates to activate different receptors.

Dopaminergic (1-2 µg/kg/minute)
1. Vasodilation in the renal, mesenteric, coronary, and intracerebral vascular beds. Renal vasodilation results in increased renal blood flow, glomerular filtration rate, urine flow, and sodium excretion.

Beta $_1$ effects (2-10 µg/kg/minute)
1. Positive chronotropic.
2. Positive inotropic.
3. Increased cardiac output.
4. Systolic blood pressure and pulse pressure may be increased with either no change or a slight increase in diastolic blood pressure. Total peripheral resistance is usually unchanged. Coronary blood flow and myocardial oxygen consumption are usually increased.

Alpha $_1$ effects (10-20 µg/kg/minute)
1. Vasoconstriction of renal, mesenteric and peripheral arteries and veins, causing increased peripheral vascular resistance. This increase of peripheral vascular resistance causes an increase in both diastolic and systolic BP and cardiac output.

(> 20 µg/kg/minute)
Potent vasoconstriction similar to norepinephrine.

ADVERSE EFFECT(S):

CVS
Tachycardia, palpitations, increased myocardial O_2 demand, PVCs,
Hypertension

GI
N/V

Other
Headache, dilated pupils

PRECAUTION(S):

1. Extravasation causes tissue necrosis (use phentolamine to reverse).
2. Alkaline solutions may inactivate (sodium bicarbonate).
3. Infusion pump is mandatory.
4. Dopamine should be tapered slowly to avoid abrupt and severe hypotension.
5. Sulfite sensitivity.
6. Patients taking MAO inhibitors (reduce dose by at least ten percent.
7. Occlusive vascular disease.
8. May cause hypertensive crisis in patients with pheochromocytoma.

CONTRAINDICATION(S):

1. Hypovolemia (use fluids).
2. Uncorrected tachydysrhythmias.

ROUTE(S) OF ADMINISTRATION:
IV infusion

ADULT DOSAGE:
5-20 µg/kg/minute

Start at 5 µg/kg/minute, increase dosage by 2-5 µg/kg/minute prn, max 20 µg/kg/minute. Titrate dosage according to BP > 90 systolic and an increase in LOC. If dose exceeds max, consider norepinephrine.

200 mg/250 mL NS = 800 µg/mL
400 mg/250 mL NS = 1600 µg/mL
800 mg/250 mL NS = 3200 µg/mL

Note: Avoid tachycardia or PVCs.

PEDIATRIC DOSAGE:
Dosage same as adult.

Prepare infusion be adding 3 mg dopamine X the child's body weight in kg added to produce a solution of 50 mL.

Infuse at 5-20 μg/kg/minute titrated to effect:

1 mL/hr = 1 μg/kg/min	5 mL/hr = 5 μg/kg/min
2 mL/hr = 2 μg/kg/min	10 mL/hr = 10 μg/kg/min
3 mL/hr = 3 μg/kg/min	15 mL/hr = 15 μg/kg/min
4 mL/hr = 4 μg/kg/min	20 mL/hr = 20 μg/kg/min

SUPPLIED FORM(S):
Preload: 200 mg/5 mL (40 mg/mL)
400 mg/10 mL (40 mg/mL)
Vial: 400 mg/ 5 mL (80 mg/mL)

ADDITIONAL INFORMATION:
1. When treating severe signs and symptoms of bradycardia (unconsciousness, poor perfusion, pre-arrest) with pharmacological agents refractory to atropine, care providers should proceed directly to an epinephrine infusion.
2. Severe hypertension may result if given to patients taking MOA inhibitors (reduce dose).
3. Seizures, severe hypotension and bradycardia may result when infused with phenytoin.
4. Do not use through the same line as thiopental.
5. Current literature suggests the dopaminergic effects of 1-5 μg/kg/minute (renal mesenteric and cerebrovascular dilation thought to produce an increase in urine output) are invalid. As a result, the starting dose of 5 μg/kg/minute was established for all cases.

droperidol **Inapsine**

CLASSIFICATION(S):
Neuroleptic (antipsychotic); Antiemetic

INDICATION(S):
1. Management of aggressive and agitated behaviour.
2. Acute and chronic psychosis.
3. Prevention or relief of N/V (Meniere's disease).

THERAPEUTIC ACTION(S):
Droperidol is a butyrophenone neuroleptic similar to haloperidol:
1. Alters the action of dopamine within the CNS to produce sedation.
2. Produces mild alpha blockade, peripheral vascular dilation and reduces the pressor effects of epinephrine.
3. Binds to postsynaptic gamma-aminobutyric acid (GABA) receptors. The binding of GABA receptors in the chemoreceptor trigger zone is the mechanism by which droperidol causes antiemetic effects.
4. Rapid onset of action (3-10 minutes) with a relatively short duration (2-4 hours); peak effect may not be apparent for up to 30 minutes.

ADVERSE EFFECT(S):

CNS
Drowsiness, extrapyramidal symptoms (use Cogentin or Benadryl to reverse)

RESP
Respiratory depression, apnea especially if given with a narcotic analgesic,
Bronchospasm

CVS
Hypotension (more pronounced with rapid administration), tachycardia, QT
prolongation, arrhythmias

PRECAUTION(S):
1. Use with caution when giving droperidol in combination with other CNS depressants (reduce dose by half).
2. May lower convulsive threshold in epileptics.
3. Elderly (reduce dose by half).
4. Renal and hepatic insufficiency.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Children two years of age or under.
3. Patients receiving vasodilators (potential for significant BP drop).
4. Hypovolemic patients (potential for significant BP drop).
5. Known QT prolonging drug use, or prolonged QT syndrome.

ROUTE(S) OF ADMINISTRATION:

IM; IV

ADULT DOSAGE:

Aggressive/Agitated Behavior

14-60 years: 5 mg IM with or without 2 mg of midazolam IM prepared in the same syringe, repeat droperidol x 1 q 15 min prn

> 60 years: 2.5 mg IM with or without 2 mg of midazolam IM prepared in the same syringe, repeat droperidol x 1 q 15 min prn

IV: **2.5 – 10 mg** SIVP

Antiemetic

1-5 mg IV or IM, q 3-6 hours

PEDIATRIC DOSAGE:

Not applicable

SUPPLIED FORM(S):

Ampule: 5 mg/2 mL (2.5 mg/mL)

ADDITIONAL INFORMATION:

1. Monitor BP closely when administering drug IV.
2. Meniere's disease is a disorder of the labyrinth of the inner ear. Signs and symptoms include vertigo, severe N/V & nystagmus (involuntary, rapid, rhythmic movement of the eyeball).
3. May produce severe dysrhythmias or cardiac arrest if given in states of prolonged QT segments.

enoxaparin **Levenox**

CLASSIFICATION(S):
Anticoagulant (low molecular weight heparin)

INDICATION(S):
1. Unstable Angina and Non-Q-Wave Myocardial Infarction.
2. Deep vein thrombosis.
3. Pulmonary embolism.

THERAPEUTIC ACTION(S):
Binds to antithrombin III and accelerates activity, inhibiting thrombin and factor Xa. These actions decrease thrombin-mediated events in coagulation, including the conversion of fibrinogen to fibrin, thereby inhibiting fibrin clot formation.

ADVERSE EFFECT(S):
CNS
Confusion

HEMAT
Hemorrhage, bruising, hematoma at injection site

Other
Fever, peripheral edema, skin necrosis at injection site

PRECAUTION(S):
1. Patients taking other anticoagulants (ASA or thrombolytics).
2. Cardiac, hepatic or renal insufficiency.
3. Medical conditions which predispose the patient to concealed hemorrhage.
4. Recent surgery or injury.
5. Elderly patients.

CONTRAINDICATION(S):
1. Hemophilia or severe clotting disorders.
2. Severe liver damage.
3. Shock.
4. Hypersensitivity to drug or pork products.
5. Active bleeding (except DIC).
6. IM injections.
7. Hx of heparin induced thrombocytopenia.
8. Do not use concurrently with unfractionated heparin.

ROUTE(S) OF ADMINISTRATION:
SC

ADULT DOSAGE:
Unstable Angina and Non-Q-Wave Myocardial Infarction
1 mg/kg SC q 12 hours in combination with oral aspirin, for a minimum of 2 days

DVT/Pulmonary Embolism
1 mg/kg SC q 12 hours or **1.5 mg/kg** SC once daily

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Prefilled syringes: 30 mg/0.3 mL, 40 mg/0.4 mL, 100 mg/1 mL

ADDITIONAL INFORMATION:
1. Monitor neurological status frequently.
2. Monitor for spinal or epidural bleeding. If neurological impairment noted, treat immediately.

epinephrine 1:1000/1:10,000 **Adrenalin**

CLASSIFICATION(S):
Sympathomimetic

INDICATION(S):
1. Cardiac Arrest – VF, Pulseless VT, Asystole and PEA.
2. Symptomatic bradycardia refractory to atropine, pacing and dopamine.
3. Anaphylaxis.
4. Relief of severe respiratory distress in anaphylaxis, chronic bronchitis, emphysema or other obstructive pulmonary disease.
5. Hypotension in the absence of hypovolemia.

THERAPEUTIC ACTION(S):

Alpha $_1$ Effects

Peripheral vasoconstriction (increases perfusion pressure during CPR which improves coronary and cerebral perfusion).

Beta $_1$ Effects
1. Positive chronotropic.
2. Positive inotropic.
3. Positive dromotropic.
4. Increases automaticity.

Beta $_2$ Effects
1. Bronchodilation.
2. Peripheral vasodilation (minimal.)

Bronchodilator Effect

Acts by stimulating beta$_2$ – adrenergic receptors in the lungs to relax bronchial smooth muscle, thereby relieving bronchospasm. This action is believed to result from increased production of cyclic adenosine 3,5-monophosphate and ensuing reduction in intracellular calcium concentration caused by activation of the enzyme adenylate cyclase that catalyzes the conversion of adenosine triphosphate (ATP) to cAMP. Increased cAMP concentrations, in addition to relaxing bronchial smooth muscle, inhibit release of mediators of immediate hypersensitivity from cells, especially from mast cells.

Allergy/Anaphylaxis Effects

Stimulates the release of cyclic adenosine monophosphate (cAMP). CAMP inhibits the release of mediators associated with allergic and anaphylactic reactions. These mediators are stored in granules within the cytoplasm of basophiles and mast cells. One of the involved mediators is histamine which is responsible for vasodilation and increased permeability of blood vessels.

Croup Effects
Epinephrine's alpha-adrenergic stimulating effects produce constriction of arteries and veins. The resulting decreased mucosal edema is thought to be the mechanism by which epinephrine and racepinephrine are beneficial in the treatment of croup.

Other
Metabolized by monoamine oxidase (MAO) and catechol-o-methyltransferase (COMT).

ADVERSE EFFECT(S):

CNS
Nervousness, headache

CVS
Tachycardia, palpitations, hypertension, increased oxygen demand leading to myocardial irritability and dysrhythmias

GI
N/V

PRECAUTION(S):
1. Cardiovascular disease.
2. Hypovolemia (treat with fluids first).
3. Elderly patients.
4. Hypertension.
5. Pregnancy.

CONTRAINDICATION(S):
1. None in anaphylactic shock or cardiac arrest.
2. Uncorrected tachydysrhythmias.

ROUTE(S) OF ADMINISTRATION:
IV; SC; ETT; IL; IO

ADULT DOSAGE:
Anaphylaxis (No Hypotension)/Bronchospasm (severe signs & symptoms)
0.3 – 0.5 mg 1:1000 SC q 5 – 30 minutes prn
0.1 mg 1:10,000 slow IV q 5 minutes prn, max 0.5 mg

epinephrine 1:1000/1:10,000 **Adrenalin**

Anaphylactic Shock (with hypotension)
0.1 mg 1:10,000 slow IV q 3-5 minutes prn

Cardiac Arrest
1.0 mg 1:10,000 IV push q 3 – 5 min prn

Elevate arm, flush with 20 mL IV solution

Symptomatic Bradycardia/Hypotension (Non hypovolemic)
2 – 10 µg/min titrate to heart rate > 60/minute, BP > 90 systolic

Infusion prepared by adding 1 mg 1:1000 in 250 mL NS = 4 µg/mL

Begin at 2 µg/minute, increase by 1 – 2 µg/min prn, max 10 µg/minute

PEDIATRIC DOSAGE:
Anaphylaxis (No Hypotension)/Bronchospasm (severe signs & symptoms)
0.01 mg/kg 1:1000 SC q 5 minutes prn, max 0.5 mg/dose

Nebulized
5 mg (5 mL) 1:1000 nebulized

Cardiac Arrest
IV: 0.01 mg/kg 1:10,000 (0.1 mL/kg), repeat q 3-5 minutes prn

ET: 0.1 mg/kg 1:1000 (0.1 mL/kg), repeat q 3-5 minutes prn

Symptomatic Bradycardia
IV: **0.01 mg/kg** 1:10,000 (0.1 mL/kg) q 3-5 minutes prn

ET: **0.1 mg/kg** 1:1000 (0.1 mL/kg) q 3-5 minutes prn

Epinephrine Infusion
Start at **0.1 µg/kg/minute**; titrate to desired effect

Increase by **0.1 µg/kg/minute** to max **1 µg/kg/minute**

Infusion prepared by adding 0.3 mg of epinephrine X the child's body weight in kg added to produce a solution of 50 mL NS

1 mL/hr = 0.1 μg/kg/min	6 mL/hr = 0.6 μg/kg/min
2 mL/hr = 0.2 μg/kg/min	7 mL/hr = 0.7 μg/kg/min
3 mL/hr = 0.3 μg/kg/min	8 mL/hr = 0.8 μg/kg/min
4 mL/hr = 0.4 μg/kg/min	9 mL/hr = 0.9 μg/kg/min
5 mL/hr = 0.5 μg/kg/min	10 mL/hr = 1 μg/kg/min

SUPPLIED FORM(S):

Ampule: 1:1000 (1 mg/mL)
Multidose Vial: 30 mg/mL (1 mg/mL)
Preload: 1:10,000 1 mg/10 mL (0.1 mg/mL)

ADDITIONAL INFORMATION:

1. Raising blood pressure and increasing heart rate may cause myocardial ischemia, angina, and increased myocardial oxygen demand.
2. Higher doses may be required to treat poison/drug-induced shock.
3. Use caution when giving epinephrine to patients on beta blockers. There is a normal balance between alpha and beta-tone on blood vessels. With the beta effect, blocked blood vessels can constrict from unopposed alpha-tone possibly resulting in hypertensive crisis if epinephrine is administered.

esmolol **Brevibloc**

CLASSIFICATION(S):
Bet –Adrenergic Receptor Blocking Agent

INDICATION(S):
1. To reduce $Beta_1$ affects in acute myocardial infarction (decrease myocardial workload and oxygen demand).
2. Rate control in SVT, PSVT, A-Fib and A-Flutter.
3. Unstable angina.
4. Emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

THERAPEUTIC ACTION(S):
1. $Beta_1$ receptor blockade resulting in negative chronotropic, inotropic, and dromotropic response. The end result is a decrease in myocardial oxygen consumption and workload.
2. Blocks the *agonistic* effects of the sympathetic neurotransmitters by competing for receptor binding sites.
3. Inhibits $Beta_2$ receptors at higher doses.

ADVERSE EFFECT(S):

CNS
Fatigue, dizziness, headache, lightheadedness

RESP
Bronchospasm, dyspnea

CVS
Bradycardia, second and third degree blocks, hypotension, CHF.

GI
N/V

PRECAUTION(S):
1. Beta blocker use in diabetic and shock patients may mask catecholamine induced signs and symptoms of acute hypoglycemia, and hypovolemia.
2. May impair recovery from hypoglycemia in diabetics because they block the effects of catecholamines that promote glycogenolysis and mobilize glucose in response to hypoglycemia.
3. Liver and renal insufficiency.

4. Administration of epinephrine for allergic and anaphylactic reactions to patients taking beta blockers may result in a hypertensive crisis. In these cases the beta effects of epinephrine are blocked allowing the vasoconstrictive alpha properties to take effect.
5. Geriatric patients may be extremely sensitive to a drop in HR and BP.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Sinus bradycardia, sick sinus syndrome, second and third degree heart blocks.
3. Right ventricular failure secondary to pulmonary hypertension.
4. Cardiogenic shock.
5. CHF.
6. Bronchospastic disease (asthma, COPD, emphysema, chronic bronchitis).
7. MI patients:
    - HR < 60 beats/minute
    - Heart blocks > first degree
    - Systolic BP < 100 mmHg
8. Concomitant use of calcium channel blockers (wait several hours), including patients on oral calcium channel blockers (may cause severe hypotension).
9. Drug-induced tachycardia (especially cocaine).
10. Drug-induced hypertension.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

0.5 mg/kg over 1 minute, followed by a continuous infusion at **0.05 mg/kg/minute**, max 0.3 mg/kg/minute

Titrate to effect – half-life of 2-9 minutes

PEDIATRIC DOSAGE:

500 µg/kg over 2 minutes, then **200 µg/kg/minute** infusion

SUPPLIED FORM(S):

Vial: 100 mg/10 mL (10 mg/mL)

ADDITIONAL INFORMATION:

1. Monitor vital signs, ECG and clinical response frequently.
2. Avoid HR < 60 beats/minute, BP < 100 mmHg.

3. Best results seen if the drug is given within two hours of the onset of signs and symptoms of AMI.
4. Concurrent administration with amiodarone may result in additive depressant effects on conduction and negative inotropic effects.
5. In drug-induced hypertension, beta blockers may only block beta receptors, leaving unopposed alpha-adrenergic stimulation and worsening hypertension. Hypertension is often short-lived so aggressive therapy for drug-induced hypertensive emergencies is rarely needed and may contribute to worsening hypotension after the hypertension resolves. Benzodiazepines are the first drug of choice for the treatment of sympathomimetic OD (i.e. cocaine).
6. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.

etomidate **Amidate**

CLASSIFICATION(S):
Hypnotic/Sedative

INDICATION(S):
1. Sedation for assisting with endotracheal intubation (RSS/RSI).
2. To maintain sedation post intubation.
3. Sedation for short-term medical procedures.

THERAPEUTIC ACTION(S):
1. Short-acting, non barbiturate hypnotic.
2. Produces rapid induction of anesthesia with minimal cardiovascular and respiratory effects.
3. Does not elevate plasma histamine or cause histamine release when administered.

ADVERSE EFFECT(S):

CNS
Myoclonic skeletal muscle movements, tonic movements

RESP
Apnea, hyperventilation, hypoventilation, laryngospasm

CVS
Hypertension, hypotension, tachycardia, bradycardia, dysrhythmias

GI
N/V

PRECAUTION(S):
1. Severe hypotension (< 70 systolic).
2. Severe asthma.
3. Severe cardiovascular disease.

CONTRAINDICATION(S):
1. Known seizure disorder.
2. Hypersensitivity.
3. Safety in children under ten years has not been established.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
0.3 mg/kg IV push over 30-60 seconds

PEDIATRIC DOSAGE:
0.2 mg/kg IV push over 30-60 seconds

SUPPLIED FORM(S):
20 mg/10 mL (2 mg/mL)

ADDITIONAL INFORMATION:
1. Onset of action is 10-20 seconds.
2. Peak onset one minute.
3. Duration 10-15 minutes.

CLASSIFICATION(S):
Narcotic (opiate); Analgesic

INDICATION(S):
1. Severe pain.
2. Sedation for assisting with endotracheal intubation (RSS/RSI).
3. To maintain sedation post intubation.

THERAPEUTIC ACTION(S):
1. It has been proposed that there are multiple subtypes of opioid receptors, each mediating various therapeutic and/or side effects of opioid drugs. The actions of an opioid analgesic may therefore depend upon its binding *affinity* for each type of receptor and, on whether it acts as a full *agonist*, partial agonist or is inactive at each type of receptor.
2. Opioid analgesics bind with stereospecific receptors at many sites within the CNS to alter processes effecting both the perception of pain and the emotional response to pain.
3. Analgesic (immediate onset, 30-60 minute duration).
4. CNS depressant – more potent, faster onset and shorter duration than morphine.

ADVERSE EFFECT(S):

CNS
Sedation, dizziness, confusion, euphoria

RESP
Respiratory depression, apnea

CVS
Hypotension, bradycardia

GI
N/V, constipation

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. Pain of unknown etiology.
3. Multiple trauma.
4. Concomitant use of CNS depressant drugs or medications.
5. Convulsive disorders. Large doses may precipitate seizures.
6. Head injury/increased ICP.

7. Bradydysrhythmias.
8. Bowel obstruction.

CONTRAINDICATION(S):

1. Hypotension (below 100 systolic).
2. Acute respiratory depression.
3. Acute exacerbation of asthma or COPD.
4. Hypersensitivity.
5. MAO inhibitor use within 14 days, may cause severe hypertension.

ROUTE(S) OF ADMINISTRATION:

IV; IM

ADULT DOSAGE:

Pain Management

1-2 µg/kg slow IV push, repeat q 5 min prn, max 100 µg/dose

RSS/RSI

2 µg/kg, max 200 µg

Sedation

1 µg/kg, max 100 µg/dose

PEDIATRIC DOSAGE:

1-2 µg/kg slow IV push/IM, max 50 µg

5-15 µg/kg intranasal

SUPPLIED FORM(S):

Ampule: 100 µg/2 mL (50 µg/mL), 250 µg/5 mL (50 µg/mL)

ADDITIONAL INFORMATION:

1. Fentanyl has respiratory depressant actions that outlast its analgesic effects.
2. Fentanyl has less emetic activity than other narcotics.
3. Short duration of action, therefore, if transport is prolonged, consider morphine or frequent boluses.
4. High doses (50-100 µg/kg) may cause severe muscle rigidity.
5. Can be used in cases of morphine allergy.
6. 100 µg of fentanyl is equal to approximately 10 mg of morphine.

CLASSIFICATION(S):
Benzodiazepine; Antagonist

INDICATION(S):
1. Complete or partial reversal of the sedative effects of benzodiazepines.
2. Isolated benzodiazepine overdose.
3. Reversal of benzodiazepine induced sedation for medical procedures (i.e. cardioversion, fracture reduction).

THERAPEUTIC ACTION(S):
1. Flumazenil selectively antagonizes or attenuates the effects of benzodiazepines in the CNS by competitively inhibiting their actions at the benzodiazepine binding site of the gamma aminobutyric acid (GABA)–benzodiazepine receptor complex. Flumazenil does not antagonize the effects of CNS-active substances that act via other receptors. Also, flumazenil does not alter the pharmacokinetics of benzodiazepines.
2. The extent to which flumazenil reverses the effects of benzodiazepine depends on the dose and plasma concentration of both medications and on the effect being assessed.
3. Flumazenil has a one to two minute onset of action, six to ten minute time to peak effect, and approximately 60-90 minute duration of action.

ADVERSE EFFECT(S):

CNS
Agitation, headache, seizures, dizziness

RESP
Dyspnea

CVS
Hypertension, tachycardia, dysrhythmias, vasodilation

GI
N/V

PRECAUTION(S):
1. Flumazenil has a shorter duration of action than other benzodiazepines, therefore, repeated doses or continuous infusions may be necessary.
2. Benzodiazepine tolerance or dependence.
3. Hepatic disease.

CONTRAINDICATION(S):

1. Hypersensitivity to flumazenil or benzodiazepines.
2. Seizure disorders (epileptic patients).
3. TCA overdose/multiple drug ingestion.
4. Overdose cases in which seizures may result.
5. Head injury.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

0.3 mg IV push over 30 seconds q 1 minute prn, max 3 mg.

Once reaching the maximum dosage,and if no improvement in level of consciousness and respiratory function is noted, the overdose must be assumed to be non-benzodiazepine.

Most overdose patients respond to a cumulative dose of between 1-3 mg.

Reversal of benzodiazepine sedation is usually evident within one to two minutes after injection.

PEDIATRIC DOSAGE:

0.01-0.02 mg/kg IV over 30 seconds q 1 minute, max 1 mg

SUPPLIED FORM(S):

Multidose Vial: 0.5 mg/5 mL (0.1 mg/mL), 1.0 mg/10 mL (0.1 mg/mL), 2.0 mg/10 mL (0.1 mg/mL)

ADDITIONAL INFORMATION:

1. Symptomatic and supportive care is usually all that is required or recommended in a pure benzodiazepine overdose.
2. Give flumazenil in small increments to wake up patient gradually.
3. Some children may have a paradoxical excitatory reaction to benzodiazepine administration. Flumazenil can reverse this reaction.

furosemide **Lasix**

CLASSIFICATION(S):
Diuretic

INDICATION(S):
1. Acute pulmonary edema/CHF.
2. Hypertensive crisis.

THERAPEUTIC ACTION(S):
1. Inhibits reabsorption of Na^+ and Cl^- from the proximal and distal tubules and the loop of Henle, and promotes renal excretion of water, Na^+, Cl^-, Mg^+, Ca^{++}, K^+. The action of furosemide on the distal tubules is independent of any inhibitory effect on arbonic anhydrase or aldosterone.
2. Diuresis usually occurs within 30 minutes and lasts for approximately 2 hours.
3. Furosemide has no significant pharmacological effects other than on a patient's renal function.
4. Diuretic effect is exerted even when glomerular filtration is markedly impaired.
5. Diuretics lower BP initially by reducing plasma and extracellular fluid volume; cardiac output also decreases.

ADVERSE EFFECT(S):

CNS
Vertigo, blurred vision, tinnitus

CVS
Hypovolemia, hypotension, dysrhythmias due to potassium depletion

Fluid & Electrolyte
Fluid/electrolyte imbalance, dehydration, metabolic acidosis, tetany (hypocalcemia).

PRECAUTION(S):
1. Patients sensitive to sulfonamides (including thiazide diuretics) may be sensitive to furosemide.
2. Renal or hepatic insufficiency.
3. Cardiogenic shock with AMI.
4. Patents receiving digitalis or potassium-depleting steroids.

CONTRAINDICATION(S):

1. ACE inhibitor use (may cause a sudden drop in blood pressure).
2. Complete renal shutdown.
3. Electrolyte imbalances (hypokalemia, hyponatremia).
4. Hypovolemia.
5. Hypotension.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

0.5 - 1.0 mg/kg slow IV push over 1-2 minutes q 30 minutes prn, max 2 mg/kg (**20 – 40 mg** most common dose)

Note: Push slow to prevent auditory disturbances.

PEDIATRIC DOSAGE:

0.5-1.0 mg/kg slow IV push q 30 minutes prn, max 2 mg/kg

SUPPLIED FORM(S):

Ampule: 20 mg/4 mL (10 mg/mL)
Preload: 40 mg/4 mL (10 mg/mL)

ADDITIONAL INFORMATION:

1. If transport time is less than 15 minutes, consider catheterization.
2. In acute pulmonary edema, if the patient is already taking furosemide, administer an initial dose that is twice the daily oral dose. If no effect is seen within 20 minutes, the initial dose should be doubled.
3. Do not administer through the same line as diltiazem, esmolol, hydralazine, midazolam, metoclorpramide and vecuronium.
4. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication aids in the antagonism of the toxic effects of hyperkalemia at the cell membrane; redistribution/intracellular shift of K^+ into cells, and elimination of excess K^+. The dosages are as follows:
    - Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose.
    - Sodium Bicarbonate – 1 mEq/kg q 15 min.
    - Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV.

- Nebulized ventolin – 10-20 mg over 15 min prn.
- Lasix – 40-80 mg slow IV push.

5. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    - 5.5 to < 6 – peaking (tenting) of T waves.
    - 6 to < 6.5 – increasing PR and QT intervals.
    - 6.5 to < 7 – flattened P waves and ST segments.
    - 7 to < 7.5 – widened QRS complexes.
    - 7.5 to < 8 – deepening S waves, merging of S and T waves.
    - 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance.
    - 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole.

glucagon

CLASSIFICATION(S):
Protein Pancreatic Hormone/Insulin Antagonist; Antihypoglycemic

INDICATION(S):
1. Confirmed hypoglycemia in which an IV cannot be established.
2. Beta blocker overdose.
3. Calcium channel blocker overdose.

THERAPEUTIC ACTION(S):
1. Promotes hepatic glycogenolysis and gluconeogenesis.
2. Stimulates adenylate cyclase to produce increased cyclic adenosine monophosphate (cAMP), which is involved in a series of enzymatic activities. The resultant effects are increased concentrations of plasma glucose, a relaxant effect on smooth musculature, and a positive chronotropic and inotropic myocardial effect via non-alpha and non-beta receptors.
3. Stimulates glycogen breakdown in the liver, converting glycogen to glucose which raises blood glucose levels. Onset of action is 5-20 minutes.
4. Hepatic stores of glycogen are necessary for glucagon to elicit an antihypoglycemic effect.
5. Secreted by alpha cells within the pancreas.

ADVERSE EFFECT(S):

CNS
Dizziness, headache

CVS
Tachycardia, hypertension

GI
N/V

Other
Rebound hypoglycemia, hypokalemia

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. Use with caution in patients with underlying cardiovascular disease due to positive $beta_1$ effects.

glucagon

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Pheochromocytoma (may cause the tumor to release catecholamines resulting in hypertensive crisis).

ROUTE(S) OF ADMINISTRATION:

IM; SC; IV

ADULT DOSAGE:

Hypoglycemia

0.5-1 mg (0.5-1 units) IM or SC repeated x 1 in 20 minutes if no effect.

Beta – Blocker Overdose / Calcium Channel Blocker Overdose

1-5 mg IV over 2-5 minutes, followed by a **1-5 mg/hour** continuous infusion. For large doses use NS to dilute.

PEDIATRIC DOSAGE:

Hypoglycemia

≤ 20 kg **0.5 mg** IM

≥ 20 kg **1 mg** IM

Beta Blocker Overdose / Calcium Channel Blocker Overdose

0.1 mg/kg IV/IM, max 2 mg

SUPPLIED FORM(S):

Vial: 1 unit of powder and 1 mL of solvent

ADDITIONAL INFORMATION:

1. $D_{50}W$ is the drug of choice in hypoglycemia.
2. Onset of action 5-20 minutes.
3. Effective only if there are sufficient stores of glycogen within the liver.
4. Once reconstitution has occurred, immediate use of the drug is preferred, however, the drug may be refrigerated up to 48 hours if necessary.
5. The solvent provided with glucagon contains phenol, which may be toxic in large doses. Use NS for reconstitution.

CLASSIFICATION(S):
Hyperglycemic

INDICATION(S):
Conscious patients with suspected hypoglycemia (intact gag reflex).

THERAPEUTIC ACTION(S):
Provides a quickly absorbed form of glucose to increase blood glucose levels.

ADVERSE EFFECT(S):

GI
N/V

PRECAUTION(S):
None

CONTRAINDICATION(S):
Decreased LOC (potential for aspiration).

ROUTE(S) OF ADMINISTRATION:
PO

ADULT DOSAGE:
25 g PO, repeat prn

PEDIATRIC DOSAGE:
Same as adult

SUPPLIED FORM(S):
Bottle: 300 mL/bottle
Gel Paste: Glucose pastes and gels in various forms

ADDITIONAL INFORMATION:
1. Oral glucose has a short duration of action because it is provided in the form of a simple carbohydrate. Therefore, follow drug administration with an oral complex carbohydrate to maintain adequate blood sugar levels.
2. Oral glucose must be swallowed because the glucose molecule is too large to be absorbed sublingually or buccally.

CLASSIFICATION(S):
Antipsychotic

INDICATION(S):
1. Treatment of acute and chronic psychosis.
2. Management of aggressive and agitated behaviour.

THERAPEUTIC ACTION(S):
1. Produces a selective effect on the cental nervous system (CNS) to produce tranquilizing effects by competitive blockade of postsynaptic dopamine (D_2) receptors in the mesolimbic dopaminergic system, and an increased turnover of brain dopamine
2. Antipsychotic action will result from subchronic therapy, depolarization blockade, or diminished firing rate of the dopamine neuron (decreased release) along with D_2 postsynaptic blockade

ADVERSE EFFECT(S):

CNS
Drowsiness, headache, seizures, extrapyramidal symptoms (i.e. tremors, dystonia, rigidity, hypersalivation, bradykinesia)

RESP
Respiratory depression, bronchospasm, laryngospasm

CVS
Hypotension, tachycardia, postural hypotension, QT prolongation

GI
Dry mouth, anorexia, constipation, N/V, hypoglycemia

PRECAUTION(S):
1. Use with caution in patients with convulsive disorders, as it may lower the seizure threshold and change the pattern and/or frequency of their seizures.
2. Elderly (reduce dose).
3. Cardiovascular disease (transient hypotension and anginal pain may be provoked).
4. Patients taking anticoagulants or lithium.
5. Impaired liver/renal function.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. CNS depression or patients taking other CNS depressants.
3. Hypotension.
4. Parkinson's disease.
5. Known QT prolonging drug use, or prolonged QT syndrome.

ROUTE(S) OF ADMINISTRATION:

IM

ADULT DOSAGE:

2-5 mg IM q 30-60 minutes prn until desired sedation is achieved

5 mg haldol mixed with 2 mg midazolam IM

PEDIATRIC DOSAGE:

Not applicable.

SUPPLIED FORM(S):

Ampule: 5 mg/mL

ADDITIONAL INFORMATION:

1. Monitor vital signs frequently.
2. Severe extrapyramidal reactions with fluoxetine, lithium and methyldopa.
3. Extrapyramidal symptoms are caused by the blockade of dopamine receptors in the nigrostriatal dopamine pathways.
4. Use diphenhydramine or cogentin to treat extrapyramidal effects.

heparin **Hepalean**

CLASSIFICATION(S):
Anticoagulant

INDICATION(S):
1. ST – segment elevation or new LBBB (if using fibrin-specific lytics).
2. ST – segment depression/dynamic T-wave inversion (strongly suspicious for ischemia). Low molecular weight heparin (i.e., enoxaparin) is preferred.
3. Prevention and treatment of venous thrombosis, pulmonary embolism, peripheral arterial embolism, and atrial fibrillation with embolization.
4. Adjunctive therapy in combination with thrombolytic administration.

THERAPEUTIC ACTION(S):
1. Heparin acts indirectly at multiple sites in both the intrinsic and extrinsic blood clotting systems to potentiate the inhibitory action of antithrombin III on several activated coagulation factors.
2. Heparin also accelerates the formation of an antithrombin III-thrombin complex, thereby inactivating thrombin and preventing the conversion of fibrinogen to fibrin. These actions prevent extension of existing thrombi.
3. Does not lyse existing clots (no fibrinolytic activity) but can prevent extension of existing clots.

ADVERSE EFFECT(S):

HEMAT
Hemorrhage

Other
Allergic reaction

PRECAUTION(S):
1. Patients taking other anticoagulants (ASA or thrombolytics).
2. Cardiac, hepatic or renal insufficiency.
3. Medical conditions which predispose the patient to concealed hemorrhage.
4. Recent surgery or injury.
5. Hyperkalemia.

CONTRAINDICATION(S):
1. Hemophilia or severe clotting disorders.
2. Severe liver damage.
3. Shock.

4. Hypersensitivity.
5. Active bleeding (except DIC).
6. IM injections.

ROUTE(S) OF ADMINISTRATION:
SC; IV; IV infusion

ADULT DOSAGE:
The goal of heparin anticoagulant therapy is to elevate the clotting duration 1.5-2 times greater than normal. Adjust dose to maintain PTT between 50 and 70 seconds.

IV-Loading Dose
5000-10,000 units over 3-5 minutes

IV Infusion
1000-1300 units/hour (20,000-40,000 units/day)

SC
5000 units q 8-12 hours
Infusion rate should be guided by PTT (partial thromboplastin time) q 6 hrs for 24 hours, then daily

PEDIATRIC DOSAGE:
Limited information

SUPPLIED FORM(S):
Vial: 30 mL (1000 units/mL), 10 mL (1000 units/mL), 5 mL (10,000 units/mL), 2 mL (25,000 units/mL)

ADDITIONAL INFORMATION:
1. To reverse the effects of heparinization, protamine sulfate should be administered by slow IV injection in doses not to exceed 50 mg in any 10 minute period.
2. Protamine sulfate on its own has anticoagulant effects. However, when given in the presence of heparin, a stable salt is formed that results in the loss of anticoagulant activity of both drugs.

CLASSIFICATION(S):
Antihypertensive; Vasodilator

INDICATION(S):
1. Hypertensive Crisis.
2. Hypertension associated with preeclampsia and eclampsia.

THERAPEUTIC ACTION(S):
1. Lowers blood pressure by acting directly on arterial smooth muscle to cause vasodilation. By altering cellular calcium metabolism, hydralazine interferes with the movement of calcium, thereby affecting the contractile state of vascular smooth muscle. Vasodilation as well as a reduction in total peripheral vascular resistance occurs, resulting in an increase in heart rate, stroke volume and cardiac output.
2. Hydralazine increases rennin activity in plasma, possibly resulting from an increase in the secretion of rennin by the renal juxtaglomerular cells in response to reflex sympathetic discharge. Increased rennin activity leads to the production of angiotensin II, which stimulates the production of aldosterone, causing a reabsorption of sodium.
3. Diastolic BP, more than systolic arterial BP, is decreased.

ADVERSE EFFECT(S):

CNS
Headache

RESP
Dyspnea

CVS
Tachycardia, palpitations, anginal symptoms, flushing, hypotension

GI
N/V

PRECAUTION(S):
1. Cardiac, hepatic, and renal insufficiency.
2. Hydralazine administration may result in postural hypotension.
3. Cerebral vascular disease or accident (abrupt decreases in blood pressure may increase cerebral ischemia).
4. Stroke, increased ICP.
5. Reduce BP slowly.

CONTRAINDICATION(S):

1. Compensatory hypertension.
2. Hypersensitivity.
3. Mitral valvular disease.
4. Acute dissecting aneurysm of the aorta.
5. Isolated right ventricular heart failure due to pulmonary hypertension (cor-pulmonale).

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

5-10 mg slow IV push q 20-30 minutes until the desirable decrease in BP is noted.

A desirable BP is defined as a diastolic of 90 – 100 mmHg. Maximal effects from hydralazine administration occur between 10 – 80 minutes.

PEDIATRIC DOSAGE:

0.1-0.5 mg/kg IV/IM q 4-6 hours prn, max 5 mg/dose

SUPPLIED FORM(S):

Ampule: 20 mg/mL

ADDITIONAL INFORMATION:

1. Sodium retention and sympathetic myocardial stimulation are common complications with hydralazine administration. To treat the sodium retention, the co-administration of thiazide diuretics is encouraged. To treat the increase in cardiac rate and output, the co-administration of a beta blocker with hydralazine is recommended.
2. Hypertensive crisis is defined as severe elevation in diastolic BP above 120 –130 mmHg with accompanying symptoms. Considered an emergency if there is evidence of rapid or progressive CNS, myocardial, hematologic or renal deterioration.

hydrocortisone **Solu-Cortef**

CLASSIFICATION(S):
Steroid

INDICATION(S):
1. Anaphylaxis.
2. Acute exacerbation of asthma/COPD.

THERAPEUTIC ACTION(S):
1. Corticosteroids diffuse across cell membranes and complex with specific cytoplasmic receptors. These complexes then enter the cell nucleus, bind to DNA and stimulate transcription of messenger RNA (mRNA) and subsequent protein synthesis of various enzymes, thought to be ultimately responsible for two categories of effects of systemic corticosteroids (anti-inflammatory, and immunosuppressant).
2. Decreases or prevents tissue responses to inflammatory processes, thereby reducing development of symptoms of inflammation without affecting the underlying cause.
3. Inhibits accumulation of inflammatory cells, including macrophages and leukocytes, lysosomal enzyme release, and synthesis and/or release of several chemical mediators of inflammation.

ADVERSE EFFECT(S):
There are no significant side effects associated with a single dose when utilized in emergencies. Most adverse effects are seen over long-term use.

CNS
Convulsions, vertigo

CVS
Hypertension

GI
N/V, hyperglycemia

Fluid & Electrolyte
Hypokalemia, fluid retention, sodium retention

PRECAUTION(S):
1. Renal and hepatic insufficiency.
2. CHF.
3. Hypertension.
4. Diabetes.

5. Recent MI.
6. Convulsive disorders.

CONTRAINDICATION(S):
None when used in an emergency setting.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
100-500 mg slow IV push or IM q 4-6 hours prn

PEDIATRIC DOSAGE:
1-2 mg/kg slow IV or IM q 4-6 hours prn

SUPPLIED FORM(S):
Mix-O-Vial: 100 mg/vial
250 mg/vial
500 mg/vial
1 g/vial

ADDITIONAL INFORMATION:
1. Once reconstituted, use within 48 hours.
2. Solu-Cortef has mineralocorticoid activity (i.e. fluid retention). It is used less frequently in the emergency setting than Solu-Medrol.
3. Pediatric patients recently having been exposed to chicken pox or who currently have the disease should not receive any steroids - as the administration of steroids in this setting may alter the immune response and result in severe disease or death.
4. Onset of action is 2 – 6 hours.
5. Do not use through the same line as midazolam or phenytoin.

ibuprofen **Motrin; Advil**

CLASSIFICATION(S):
Nonsteroidal Anti-Inflammatory Drug (NSAID)

INDICATION(S):
1. Treatment of mild pain.
2. Reduction of fever.
3. Anti-inflammatory.

THERAPEUTIC ACTION(S):
Inhibits the activity of the enzyme cyclo-oxygenase, resulting in decreased formation of precursors of prostaglandins and thromboxanes from arachidaonic acid.

ADVERSE EFFECT(S):

CNS
Dizziness, drowsiness, lightheadedness

CVS
Water retention, peripheral edema

Other
Diarrhea, N/V, abdominal pain

PRECAUTION(S):
1. Renal impairment.
2. Hx of GI bleed.
3. Elderly patients.
4. CHF.

CONTRAINDICATION(S):
1. Hypersensitivity to NSAIDS/salicylates.
2. Pregnancy.
3. ASA induced asthma.

ROUTE(S) OF ADMINISTRATION:
PO

ibuprofen **Motrin; Advil**

ADULT DOSAGE:
300-800 mg PO q 6-8 hours, max 3200 mg/day

Anti-Inflammatory
600 mg PO q 6-8 hours X 7 days, max 2400 mg/day

PEDIATRIC DOSAGE:
10 mg/kg PO q 6-8 hours, max 50 mg/kg/day

SUPPLIED FORM(S):
Suspension: 40 mg/mL
Tablet: 300, 400, 600

ADDITIONAL INFORMATION:
1. May produce GI bleeding in chronic alcoholics.
2. Ibuprofen may increase digoxin serum levels.
3. Antihypertensive effects of beta blockers may be reduced.

insulin crystalline **Regular insulin; Toronto insulin; CZI**

CLASSIFICATION(S):
Antidiabetic agent; Hormone

INDICATION(S):
Treatment of severe ketoacidosis or diabetic coma.

THERAPEUTIC ACTION(S):
1. Increases glucose transport across the cell membrane in muscle and fat.
2. Stimulates protein metabolism by increasing amino acid transport across the cell membrane.
3. Stimulates fat metabolism by increasing triglyceride synthesis and increasing fatty acid transport across the cell membranes.
4. Increases hepatic glucose conversion to glycogen and suppresses hepatic glucose output
5. Increases the intracellular shift of potassium and magnesium, and decreases renal excretion of sodium.

ADVERSE EFFECT(S):

CNS
Blurred vision, drowsiness

Other
Hypoglycemia

PRECAUTION(S):
1. Renal or hepatic impairment.
2. Hypokalemia.

CONTRAINDICATION(S):
1. Hypoglycemia.
2. Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
IV; IM; SC

ADULT DOSAGE:
100-200 units in two equal portions (half IV, half SC), then **20-50 units** IV/SC q 30 minutes according to BGL levels, max single IV dose 200 units
Dilute IV doses in 10 mL NS

PEDIATRIC DOSAGE:

Loading Dose
0.1 units/kg slow IV push

Maintenance
0.05-0.1 units/kg/hour

Dilute to a concentration of 0.2-1.0 units/mL.

SUPPLIED FORM(S):
Vial: 100 units/mL, 10 mL vial

ADDITIONAL INFORMATION:

1. Carefully monitor patients who have switched from one type of insulin to another; dosage adjustments are often needed.
2. Avoid vigorous handling of the vial.
3. Avoid concentrated insulin in IV use.
4. Do not administer through the same line as dopamine or norepinephrine.
5. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication aids in the antagonism of the toxic effects of hyperkalemia at the cell membrane, redistribution/intracellular shift of K^+ into cells, and elimination of excess K^+. The dosages are as follows:
    - Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose.
    - Sodium Bicarbonate – 1 mEq/kg q 15 min.
    - Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV.
    - Nebulized ventolin – 10-20 mg over 15 min prn.
    - Lasix – 40-80 mg slow IV push.
6. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    - 5.5 to < 6 – peaking (tenting) of T waves.
    - 6 to < 6.5 – increasing PR and QT intervals.
    - 6.5 to < 7 – flattened P waves and ST segments.
    - 7 to < 7.5 – widened QRS complexes.
    - 7.5 to < 8 – deepening S waves, merging of S and T waves.
    - 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance.
    - 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole.

ipratropium **Atrovent**

CLASSIFICATION(S):
Anticholinergic Bronchodilator; Parasympatholytic

INDICATION(S):
Treatment of acute asthma attack, COPD, chronic bronchitis and emphysema in conjunction with $Beta_2$ adrenergic agonists (salbutamol).

THERAPEUTIC ACTION(S):
1. Produces bronchodilation by competitive inhibition of cholinergic receptors on bronchial smooth muscle. This effect antagonizes the action of acetylcholine at its membrane-bound receptor site and serves to blocks the brochoconstrictor action of vagal efferent impulses.
2. Bronchial secretions are also decreased by a blockade of acetylcholine, which inhibits parasympathetic stimulation.
3. Onset of action is 5-15 minutes, with a peak at 1-2 hours.

ADVERSE EFFECT(S):

CNS
Nervousness, headache, dizziness, tremors

GI
Dry mouth/throat, bad taste

Other
Acute eye pain, epistaxis

PRECAUTION(S):
1. Patients on other anticholinergic drugs.
2. Pregnancy.
3. Narrow angle glaucoma (avoid misting into eyes).

CONTRAINDICATION(S):
Known hypersensitivity to atrovent or atropine agents.

ROUTE(S) OF ADMINISTRATION:
Nebulize

ADULT DOSAGE:
250 – 500 µg mixed with or without salbutamol q 4-6 hours

PEDIATRIC DOSAGE:
< 10 kg: **125 µg**
10-20 kg: **250 µg**
> 20 kg: **500 µg**

SUPPLIED FORM(S):
Glass bottle: 20 mL (250 µg/mL of 0.025% solution)
Nebule: 2 mL (250 µg/mL)
1 mL (250 µg/mL)

ADDITIONAL INFORMATION:
1. Use non-humidified O_2 source at 6-8 L/minute.
2. Enhanced by other anticholinergic drugs.
3. Metered inhalers may contain soya or peanut products (potential for allergic reaction).

ipratropium/fenoterol **Duovent**

CLASSIFICATION(S):
Bronchodilator

INDICATION(S):
Treatment of bronchospasm from asthma, chronic bronchitis, COPD and emphysema.

THERAPEUTIC ACTION(S):

1. Combination anticholinergic bronchodilator (ipratropium) and $beta_2$ adrenergic bronchodilator (fenoterol).
2. Ipratropium produces bronchodilation by competitive inhibition of cholinergic receptors on bronchial smooth muscle. This effect antagonizes the action of acetylcholine at its membrane-bound receptor site, thereby blocking the brochoconstrictor action of vagal efferent impulses. Onset of action is 5-15 minutes, with a peak at one to two hours.
3. Fenoterol acts by stimulating $beta_2$ receptors in the lungs to relax bronchial smooth muscle, thereby relieving bronchospasm. This action is believed to result from increased production of cyclic adenosine 3,5-monophosphate (cyclic 3,5-AMP; cAMP) and the ensuing reduction in intracellular calcium concentration caused by activation of the enzyme adenylate cyclase that catalyzes the conversion of adenosine triphosphate (ATP) to cAMP. Increased cAMP concentrations, in addition to relaxing bronchial smooth muscle, inhibit the release of mediators of immediate hypersensitivity from cells, especially from mast cells. Onset of action is five minutes, peak at 30– 60 minutes.

ADVERSE EFFECT(S):

CNS
Nervousness, dizziness, headache

RESP
Paradoxical bronchoconstriction (rare)

CVS
Tachycardia, palpitations

GI
Dry mouth/throat, bad taste

Other
Tremors

PRECAUTION(S):

1. Patients on other anticholinergic drugs.
2. Narrow angle glaucoma (avoid misting into eyes).
3. Pregnancy.

CONTRAINDICATION(S):

1. Tachydysrhythmias.
2. Known hypersensitivity to product or atropine agents.

ROUTE(S) OF ADMINISTRATION:

Nebulized

ADULT DOSAGE:

500 µg of ipratropium and **1.25 mg** of fenoterol mixed in a total of 4 mL NS q 6 hrs prn

PEDIATRIC DOSAGE:

Not applicable

SUPPLIED FORM(S):

Nebule: 4 mL contains 500 µg ipratropium and 1.25 mg fenoterol in NS

ADDITIONAL INFORMATION:

Use non-humidified O_2 source at 6-8 L/minute.

ipratropium/salbutamol sulfate **Combivent**

CLASSIFICATION(S):
Bronchodilator

INDICATION(S):
Treatment of acute bronchospasm from asthma, COPD, pulmonary edema and chronic bronchitis.

THERAPEUTIC ACTION(S):
1. Combination anticholinergic bronchodilator (ipratropium) and $beta_2$ adrenergic bronchodilator (salbutamol).
2. Ipratropium produces bronchodilation by competitive inhibition of cholinergic receptors on bronchial smooth muscle. This effect antagonizes the action of acetylcholine at its membrane-bound receptor site, thereby blocking the brochoconstrictor action of vagal efferent impulses. Onset of action is 5-15 minutes, with a peak at 1-2 hours.
3. Salbutamol acts by stimulating $beta_2$ receptors in the lungs to relax bronchial smooth muscle, thereby relieving bronchospasm. This action is believed to result from increased production of cyclic adenosine 3,5-monophosphate (cyclic 3,5-AMP; cAMP) and ensuing reduction in intracellular calcium concentration caused by activation of the enzyme adenylate cyclase that catalyzes the conversion of adenosine triphosphate (ATP) to cAMP. Increased cAMP concentrations, in addition to relaxing bronchial smooth muscle, inhibit release of mediators of immediate hypersensitivity from cells, especially from mast cells. Onset of action is 5-15 minutes.

ADVERSE EFFECT(S):

CNS
Headache, nervousness, tremors

CVS
Tachycardia, palpitations

Other
Coughing, paradoxical bronchospasm (rare)

PRECAUTION(S):
1. Narrow angle glaucoma (avoid misting into eyes).
2. Patients on other anticholinergic drugs.
3. Pregnancy.

ipratropium/salbutamol sulfate **Combivent**

CONTRAINDICATION(S):

1. Tachydysrhythmias.
2. Known hypersensitivity to product or atropine agents.

ROUTE(S) OF ADMINISTRATION:

Nebulized

ADULT DOSAGE:

500 µg of ipratropium and **2.5 mg** salbutamol in 2.5 mL NS nebulized q 4-6 hrs prn.

PEDIATRIC DOSAGE:

½ nebule diluted to 5 mL with NS nebulized.

SUPPLIED FORM(S):

500 µg ipratopium/2.5 mg salbutamol in 2.5 mL NS

ADDITIONAL INFORMATION:

Use non-humidified oxygen at 6-8 L/minute.

isoproterenol **Isuprel**

CLASSIFICATION(S):
Sympathomimetic

INDICATION(S):
1. Treatment of hemodynamically significant bradycardia in denervated transplanted heart patients.
2. Treatment of hemodynamically significant bradycardia refractory to pacing, atropine, dopamine, and epinephrine.
3. Beta blocker overdose (glucagon, dopamine and pacing preferred).

THERAPEUTIC ACTION(S):
Isoproterenol is a pure beta receptor agonist. It is a potent inotrope and chronotrope, increasing cardiac output despite a reduction in mean blood pressure due to peripheral vasodilation.

ADVERSE EFFECT(S):

CNS
Headache, anxiety, dizziness

CVS
Tachycardia, palpitations, hypotension, PVCs, angina, increased myocardial oxygen demand leading to increased cardiac ischemia, VT, VF

GI
N/V

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. AV node dysfunction.
3. Coronary artery disease, cardiogenic shock.
4. D/C if signs of ischemia worsen.
5. Administration may exacerbate tachydysrhythmias due to digitalis toxicity and precipitate hypokalemia.

CONTRAINDICATION(S):
1. Cardiac arrest.
2. Hypotension (use fluids and vasopressors).
3. Uncorrected tachydysrhythmias.
4. Digitalis toxicity.
5. Do not administer with epinephrine (may cause VF/VT).

6. Do not administer to patients with poison/drug-induced shock (except a beta blocker overdose).

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
2 – 10 µg/minute titrated to HR > 60 beats/minute (avoid angina, tachycardia or PVCs)

Mix 1 mg in 250 mL D_5W or NS = 4 µg/mL
Begin at 2 µg/minute, increase by 1–2 µg/minute prn; max 10 µg/minute

PEDIATRIC DOSAGE:
Start at **0.5 µg/kg/minute**, increase q 5 minutes by **0.1 µg/kg/minute** until desired HR & BP is obtained, max 1 µg/kg/minute

SUPPLIED FORM(S):
Ampules: 0.2 mg/mL, 1 and 5 mL ampules

ADDITIONAL INFORMATION:
1. Isoproterenol should be used with extreme caution. At low doses, it may be helpful but at higher doses - it can be harmful.
2. Isoproterenol requires a delicate risk-to-benefit decision as patients who are ill enough to receive isoproterenol, are probably too ill to tolerate it.

CLASSIFICATION(S):
Hypnotic; Amnesic; Analgesic

INDICATION(S):
1. Sedation for assisting with endotracheal intubation (RSS/RSI).
2. Anesthetic agent for short-term medical procedures.

THERAPEUTIC ACTION(S):
1. Blocks afferent impulses associated with the affective-emotional component of pain perception within the medial medullary reticular formation. Serves to help suppress spinal cord activity and to interact with several CNS transmitter systems.
2. Relaxes bronchial smooth muscle.
3. Onset of action is 15-30 seconds with IV administration. Duration of action is 5-10 minutes.

ADVERSE EFFECT(S):

CNS
Delirium, tremors, increased ICP, hallucinations

RESP
Respiratory depression, laryngospasm

CVS
Hypotension/Hypertension, bradycardia, tachycardia

GI
N/V

Other
Nystagmus, fasiculations, diplopia, increased secretions

PRECAUTION(S):
1. Impaired hepatic function.
2. Tachyarrhythmias may be exacerbated.

CONTRAINDICATION(S):

1. Hypertension.
2. Increased ICP.
3. CHF.
4. Thyrotoxicosis.
5. Children under three years of age.
6. Pulmonary infections.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
Initial Dose
1-4 mg/kg IV over 1 minute or **5-10 mg/kg** IM

Maintenance Dose
Repeat at half the initial dose q 5-8 minutes

PEDIATRIC DOSAGE:
1-4 mg/kg IV repeat x 1 or **1-2 mg/kg** IM repeat x 1

SUPPLIED FORM(S):
Vial: 10 mg/mL, 50 mg/mL, and 100 mg/mL

ADDITIONAL INFORMATION:

1. May require atropine prior to administration (specifically in pediatrics).
2. Limited or no respiratory depression.

CLASSIFICATION(S):
Nonsteroidal Anti-inflammatory Analgesic

INDICATION(S):
Treatment of mild to moderate pain.

THERAPEUTIC ACTION(S):
1. Inhibits the activity of the enzyme cyclo-oxygenase, resulting in decreased formation of precursors of prostaglandins and thromboxanes from arachidaonic acid.
2. With analgesic doses, little anti-inflammatory or antipyretic activity is seen.
3. Ketorolac acts peripherally, compared to narcotics that act on the CNS. Therefore, there's no CNS depression.

ADVERSE EFFECT(S):

CNS
Dizziness, headache, drowsiness

RESP
Bronchospasm

GI
Heartburn, nausea, diarrhea, renal failure

Skin
Rash, edema

PRECAUTION(S):
1. GI tract irritation and hemorrhage with long-term use.
2. Hepatic insufficiency.
3. Hypertension.
4. CHF.
5. Elderly patients.

CONTRAINDICATION(S):
1. Hypersensitivity to ketorolac, ASA, NSAIDS.
2. Asthmatics due to bronchospastic activity.
3. Renal impairment.

4. Patients at risk for hemorrhage as ketorolac inhibits platelet function, thereby increasing bleeding time.

ROUTE(S) OF ADMINISTRATION:
PO; IM; IV

ADULT DOSAGE:
PO
10 mg po q 4-6 hrs max 40 mg/day

IM/IV
30-60 mg q 4-6 hours prn, max 120 mg/day

PEDIATRIC DOSAGE:
Under six months
0.5 mg/kg IM/IV q 4-6 hours, max 30 mg/dose, and 0.5 mg/kg/72 hrs

SUPPLIED FORM(S):
Tablet: 10 mg/tablet
Ampule: 30 mg/mL

ADDITIONAL INFORMATION:
1. Pain relief is comparable whether using IM or PO.
2. Peak analgesic effects occur 2-3 hours after administration.
3. The greatest difference between large and small doses of the drug administered by either route is the duration of the analgesia.

labetalol **Trandate**

CLASSIFICATION(S):
Beta–Adrenergic Receptor Blocking Agent

INDICATION(S):
1. To reduce $Beta_1$ effects in acute myocardial infarction (decrease myocardial workload and oxygen demand).
2. Rate control in SVT, PSVT, A-Fib, and A-Flutter.
3. Unstable angina pectoris.
4. Emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

THERAPEUTIC ACTION(S):
1. $Beta_1$ receptor blockade resulting in negative chronotropic, inotropic, and dromotropic response. End result is a decrease in myocardial oxygen consumption and workload.
2. Blocks the agonistic effects of the sympathetic neurotransmitters by competing for receptor binding sites.
3. Inhibits $Beta_2$ receptors at higher doses.

ADVERSE EFFECT(S):

CNS
Fatigue, dizziness, headache, lightheadedness

RESP
Bronchospasm, dyspnea

CVS
Bradycardia, 2^{nd} & 3^{rd} degree blocks, hypotension, CHF

GI
N/V

PRECAUTION(S):
1. Beta blocker use in diabetic and shock patients may mask catecholamine-induced signs and symptoms of acute hypoglycemia and hypovolemia.
2. May impair recovery from hypoglycemia in diabetics because they block the effects of catecholamines, which promote glycogenolysis and mobilize glucose in response to hypoglycemia.
3. Liver and renal insufficiency.

4. Administration of epinephrine for allergic and anaphylactic reactions to patients taking beta blockers may result in an hypertensive crisis. In these cases, the beta effects of epinephrine are blocked - allowing the vasoconstrictive alpha properties to take effect.
5. Geriatric patients may be extremely sensitive to a drop in HR and BP.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Sinus bradycardia, sick sinus syndrome, second and third degree heart blocks.
3. Right ventricular failure (secondary to pulmonary hypertension).
4. Cardiogenic shock.
5. CHF.
6. Bronchospastic disease (asthma, COPD, emphysema, chronic bronchitis).
7. MI patients:
    - HR < 60 beats/minute.
    - Heart blocks > first degree.
    - Systolic BP < 100 mmHg.
8. Concomitant use of calcium channel blockers (wait several hours), including patients on oral calcium channel blockers (may cause severe hypotension).
9. Drug-induced tachycardia (especially cocaine).
10. Drug-induced hypertension

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

10 mg IV push over 1-2 minutes

May repeat or double dose q 10 minutes to a max of 150 mg, or give initial dose as a bolus, then start an infusion at 2-8 mg/min.

PEDIATRIC DOSAGE:

Not applicable

SUPPLIED FORM(S):

Ampule: 5 mg/mL, 20 mL

ADDITIONAL INFORMATION:

1. Monitor vital signs - ECG and clinical response – frequently.
2. Avoid HR < 60 beats/minute, BP < 100 mmHg.
3. Best results seen if the drug is given within 2 hours of the onset of signs and symptoms of AMI.
4. Concurrent administration with amiodarone may result in additive depressant effects on conduction and negative inotropic effects.
5. In drug-induced hypertension, beta blockers may only block beta receptors, leaving unopposed alpha-adrenergic stimulation and worsening hypertension. Hypertension is often short-lived so aggressive therapy for drug-induced hypertensive emergencies is rarely needed, and may contribute to worsening hypotension after the hypertension resolves. Benzodiazepines are the first drug of choice for the treatment of sympathomimetic OD (i.e. cocaine).
6. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.

CLASSIFICATION(S):
Antidysrhythmic; Local Anesthetic

INDICATION(S):
1. Treatment of stable VT.
2. Treatment of VF/Pulseless VT.
3. Recurrent VF/Pulseless VT.
4. Wide complex tachycardia of unknown type.
5. Suppression of symptomatic PVCs (treatment of PVCs is controversial):
    - 6/minute
    - R on T phenomenon
    - Multifocal
    - Salvos
6. Preintubation of head injuries.

THERAPEUTIC ACTION(S):
1. Decreases the depolarization, automaticity, and excitability in the ventricles during the diastolic phase by a direct action on the tissues, especially the Perkinje network, without involvement of the autonomic system. Neither contractility, systolic arterial BP, AV conduction velocity, nor absolute refractory period, is altered.
2. Suppresses re-entry arrhythmias by prolonging the refractory period (phase 4).
3. Increases the threshold for VF.
4. Suppresses PVCs by decreasing automaticity.
5. Depresses the neurological response to airway manipulation which results in elevated ICP (the exact mechanism is unknown).
6. Type 1B antidysrhythmic agent with local anesthetic properties.

ADVERSE EFFECT(S):

CNS
CNS depression, drowsiness, confusion, slurred speech, tremors leading to seizures*

CVS
Bradycardia, hypotension, and conduction disturbances*

Other
Visual, auditory disturbances, tinnitus*
** Indicates lidocaine toxicity.*

PRECAUTION(S):
Reduce rebolus dose by half in the following:

- 70 years of age.
- CHF, AMI, shock.
- Renal or hepatic insufficiency.

With situations such as the above, bolus at 0.75-1 mg/kg, then decrease the rebolus dosage by half to 0.25 mg/kg.

CONTRAINDICATION(S):

1. Bradycardic rhythms with rate related PVCs.
2. Bradycardias, second and third degree heart blocks.
3. Idioventricular rhythms.
4. Hypersensitivity.
5. WPW.
6. Adams-stokes syndrome.

ROUTE(S) OF ADMINISTRATION:
IV; ETT

ADULT DOSAGE:
Cardiac Arrest (VF or Pulseless VT)
1.5 mg/kg IV push, repeat q 3-5 minutes at **1.5 mg/kg**, max 3 mg/kg

PVC/Stable VT
1-1.5 mg/kg slow IV push, then **0.5-0.75 mg/kg** q 5-10 minutes, max 3 mg/kg

Preintubation of Head Injuries
1.5 mg/kg slow IV push

Lidocaine Infusion
2-4 mg/minute

Infusion prepared by adding 1 g/250 mL D_5W = 4 mg/mL

Note: With cardiac arrest - use bolus therapy only (allow two minutes to reach central circulation with CPR).

With post conversion from cardiac arrest, begin drip when palpable pulse present, and no contraindications.

If VT, PVCs or recurrent arrhythmias persist after the initial bolus dosage is administered, rebolus at half the original dosage and increase the lidocaine drip by one mg/minute.

PEDIATRIC DOSAGE:

Bolus
1 mg/kg

Infusion
20-50 µg/kg/minute

SUPPLIED FORM(S):
Preload: 100 mg/5 mL (20 mg/mL) bolus therapy
Premixed Bag: 1g/250 mL (4 mg/mL)
2 g/500 mL (4 mg/mL)
Preload: 1 g/5 mL (200 mg/mL)

ADDITIONAL INFORMATION:

1. Administration of propranolol during infusion of lidocaine may increase the plasma concentration of lidocaine by approximately 30 percent.
2. Dosage should not exceed 300 mg/hour.
3. Lidocaine currently has a *class indeterminate recommendation* in ACLS which means that there is insufficient evidence to support its use as an antiarrhythmic drug (no harm, but no benefit).
4. Therapeutic levels from a bolus dose of lidocaine last approximately 20 minutes.
5. Lidocaine is the antiarrhythmic of choice for treatment of cocaine induced monomorphic VT and VF associated with myocardial ischemia.
6. Digitalis induced ventricular arrhythmias normally respond to simple administration of potassium, magnesium, and normal saline. Lidocaine however remains the antiarrhythmic of choice, if ventricular arrhythmias persist after initial therapy and are deemed unsuccessful.

CLASSIFICATION(S):
Topical Anesthetic

INDICATION(S):
Provides surface anesthesia to the oropharyngeal and tracheal areas which reduces reflex activity during endotracheal intubation.

THERAPEUTIC ACTION(S):
1. Endotracheal lidocaine, when applied topically to the oral cavity, acts on mucous membranes to produce a local anesthesia.
2. Anesthesia occurs usually within one to five minutes and persists for approximately 10-15 minutes.

ADVERSE EFFECT(S):

CNS
CNS depression, seizures*

CVS
Bradycardia, hypotension and conduction disturbances*

Other
Local irritation at the application site

** Indicates lidocaine toxicity.*

PRECAUTION(S):
1. The lowest dosage that results in effective anesthesia should be used to avoid high plasma levels and serious adverse effects.
2. Food should not be ingested for 60 minutes following use of local anesthetic preparations in the mouth or throat area.

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
Spray

ADULT DOSAGE:
2-10 metered dose sprays (10 mg/spray)

PEDIATRIC DOSAGE:
3-12 years: **2** metered sprays (10 mg/spray)

SUPPLIED FORM(S):
Non-aerosol spray bottles of 30 mL with a metered dose valve.

ADDITIONAL INFORMATION:
When Xylocaine Endotracheal is used concomitantly with other lidocaine products, the total dose contributed by all formulations must be kept in mind (max three mg/kg).

lorazepam **Ativan**

CLASSIFICATION(S):
Benzodiazepine; Anticonvulsant; Sedative; Antianxiety agent

INDICATION(S):
1. Anticonvulsant therapy in status epilepticus (benzodiazepine of choice).
2. Sedation prior to cardioversion.
3. Acute anxiety.

THERAPEUTIC ACTION(S):
1. Reduces the ability of the neuron to depolarize to the threshold required to produce an action potential. Thus, the seizure threshold is raised.
2. Suppresses the spread of seizure activity produced by epileptogenic foci in the cortex, thalamus, and limbic structures but does not abolish the abnormal discharge of the focus.
3. Potentiates gamma aminobutyric acid (GABA), an inhibitory neurotransmitter. Activation of the GABA receptor results in the opening of the chloride channel, allowing the flow of chloride ions into the neuron. This results in hyperpolarization, which inhibits firing of the neuron and translates into decreased neuronal excitability, thus attenuating the effects of subsequent depolarizing excitatory transmitters.
4. Decreases seizure activity by enhanced presynaptic inhibition.
5. Produces skeletal muscle relaxation primarily by inhibiting spinal polysynaptic afferent pathways. May also directly depress motor nerve and muscle function.
6. CNS depressant.
7. Muscle relaxant.

ADVERSE EFFECT(S):

CNS
Drowsiness

RESP
Respiratory depression

CVS
Hypotension (rare), bradycardia

GI
N/V

PRECAUTION(S):

1. Elderly patients (decrease dosage).
2. Patients with renal and hepatic impairment.
3. Extravasation causes tissue necrosis.
4. Concomitant use of CNS depressants.

CONTRAINDICATION(S):
Hypersensitivity to benzodiazepines.

ROUTE(S) OF ADMINISTRATION:
IV; IM; SL

ADULT DOSAGE:
Seizures
0.05 mg/kg slow IV push (< 2 mg/minute) total single dose is **4 mg**; repeat q 10-15 minutes x 1, max 8 mg

If seizures continue, utilize alternative therapy.

Cardioversion
1-2 mg slow IV push (< 2 mg/min) until desired effect

Prior to IV use, lorazepam injection should be diluted with an equal amount of NS

Acute Anxiety
0.5-1 mg SL repeat prn

PEDIATRIC DOSAGE:
Seizures
0.05 mg/kg; Max dose is 2 mg

SUPPLIED FORM(S):
Vial: 1 mL (4 mg/mL)
Tablet: 0.5 or 1 mg

Keep refrigerated and protected from light.

ADDITIONAL INFORMATION:

1. Have intubation equipment available.
2. Have flumazenil as an antidote.
3. Lorazepam has a longer anticonvulsant effect, and less RESP depression than diazepam.
4. Following IM, administration absorption is rapid and complete whereas diazepam's absorption may be slow and erratic, depending on the site of administration.

magnesium sulfate

CLASSIFICATION(S):
Electrolyte; Anticonvulsant; Antiarrhythmic

INDICATION(S):
1. Treatment of magnesium deficiency related dysrhythmias (hypomagnesemia):
    - Torsades de pointe.
    - Recurrent and refractory VF/Pulseless VT.
    - Maintain a high index of suspicion with malnourished and/or alcoholic patients.
2. TCA induced torsades de pointe.
3. Prevention and control of seizures related to eclampsia (pregnancy-induced hypertension).
4. Severe bronchospasm.

THERAPEUTIC ACTION(S):
1. **Anticonvulsant effects:** Decreases the amount of acetylcholine released at the myoneuronal junction, resulting in depression of neuromuscular transmission. Magnesium may also have a direct effect on smooth muscle and may cause CNS depression.
2. **Antiarrhythmic effects:** Decreases myocardial cell excitability by contributing to the re-establishment of ionic equilibrium and by stabilizing cell membranes. Magnesium also appears to modulate the sodium current, the slow inward calcium current, and at least one potassium current.
3. **Tocolytic effects:** Decreases myometrial contractility by altering calcium uptake, binding, and distribution in smooth muscle cells. Magnesium has been shown to increase uterine blood flow secondary to vasodilation of uterine vessels.
4. Peripheral vasodilator.

ADVERSE EFFECT(S):

CNS
Drowsiness, sedation

RESP
Respiratory depression

CVS
Bradycardia, dysrhythmias, hypotension, facial flushing

Other
Hypothermia, diaphoresis, muscle weakness

magnesium sulfate

PRECAUTION(S):

1. Rapid IV administration may cause respiratory or cardiac arrest.
2. Patients receiving digitalis.

CONTRAINDICATION(S):

1. Hypocalcemia.
2. Heart block.
3. Respiratory depression.
4. Hypotension.
5. Renal failure (decreases clearance - risk of toxicity).

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Torsades de pointes

1-2 g slow IV push over 5 minutes

Infusion (post conversion of torsades)

1 g/hour

Refractory VF/Pulseless VT

1-2 g IV push

Eclampsia (Pregnancy Induced Hypertension)

2-4 g slow IV push over 3 minutes

Bronchospasms

2 g diluted in 50 mL NS infused over 5 minutes

PEDIATRIC DOSAGE:

25-50 mg/kg over 5-10 minutes, max 2 grams (administer IVP in cardiac arrest)

SUPPLIED FORM(S):

Ampule: 5 g/10 mL (500 mg/mL)
Vial: 5 g/10 mL (500 mg/mL)

ADDITIONAL INFORMATION:

1. Hypermagnesemia may result in the loss of deep tendon reflexes, flaccid paralysis, respiratory depression, heart block and circulatory collapse.
2. Hypermagnesemia can be reversed by calcium chloride given at 8-16 mg/kg.
3. Some patients may develop arrhythmias due to tricyclic actions on phase two of the action potential. The phase two effects are initially manifested by a prolongation of the QT interval. But they may also result in the torsades de pointes variant of VT.
4. Magnesium sulfate was once thought to decrease the mortality rate in the setting of acute myocardial infarction. Recent data from the ISIS-4 study showed magnesium was ineffective in significantly reducing mortality, independent of thrombolytic or antiplatelet therapy, in patients with suspected acute myocardial infarction. There was no significant evidence that magnesium had any effect on five-week mortality, and follow-up at one year did not indicate any beneficial effect. In direct contrast to the results of some earlier studies, administration of IV magnesium was associated with small but significant increases in heart failure, cardiogenic shock, and in deaths attributed to cardiogenic shock.

CLASSIFICATION(S):
Osmotic diuretic

INDICATION(S):
Raised ICP or cerebral edema in a head injury patient.

THERAPEUTIC ACTION(S):
1. Mannitol elevates blood plasma osmolarity, resulting in enhanced flow of water from tissues, including the brain and cerebrospinal fluid, into interstitial fluid and plasma. As a result - cerebral edema, elevated intracranial pressure, and cerebrospinal fluid volume and pressure - may be reduced.
2. Induces diuresis because mannitol is not reabsorbed in the renal tubule, thereby increasing the osmolarity of the glomerular filtrate, facilitating excretion of water, and inhibiting the renal tubular reabsorption of sodium, chloride, and other solutes.

ADVERSE EFFECT(S):

CNS
Headache, confusion

CVS
Transient volume overload, pulmonary edema, CHF, tachycardia, angina

GI
N/V

Fluid & Electrolyte
Electrolyte imbalance (hyponatremia), dehydration

PRECAUTION(S):
1. Extravasation causes tissue necrosis.
2. Monitor patient for dehydration.
3. Catheterize and monitor urine output.

CONTRAINDICATION(S):
1. Severe hypotension, dehydration or hyponatremia.
2. Pulmonary edema/CHF (may cause a sudden expansion of extracellular fluid resulting in acute pulmonary edema).
3. Active intracranial hemorrhage.
4. Renal failure.

ROUTE(S) OF ADMINISTRATION:
IV infusion

ADULT DOSAGE:
0.25-2 g/kg IV infusion over 15 minutes, repeat after 30 minutes if no effects seen. Current trend is to start at lower doses of 0.25 g/kg.

Note: Infusion should be run through an in-line filter, in order to filter any crystals out of the solution.

PEDIATRIC DOSAGE:
0.5-1 g/kg IV infusion over 5-10 minutes, repeat q 4-6 hours at 0.25-2 g/kg

SUPPLIED FORM(S):
Premixed bag: 100 g/500 mL of 20% solution (200 mg/mL)

ADDITIONAL INFORMATION:
1. May crystallize at low temperatures, less than seven degrees Celsius (if crystallization does occur, agitate and re-warm the solution).
2. Priority treatment for elevated ICP or cerebral edema is intubation and adequate oxygenation/ventilation.

meperidine **Demerol**

CLASSIFICATION(S):
Narcotic (opiate); Analgesic

INDICATION(S):
Relief of moderate to severe pain.

THERAPEUTIC ACTION(S):
1. It has been proposed that there are multiple subtypes of opioid receptors, each mediating various therapeutic and/or side effects of opioid drugs. The actions of an opioid analgesic may therefore depend upon its binding affinity for each type of receptor and on whether it acts as a full *agonist*, partial agonist or is inactive at each type of receptor.
2. Opioid analgesics bind with stereospecific receptors at many sites within the CNS to alter processes effecting both the perception of pain and the emotional response to pain.
3. CNS depression/sedation.
4. One tenth as potent as morphine.

ADVERSE EFFECT(S):

CNS
Sedation, lethargy

RESP
Respiratory depression, apnea

CVS
Hypotension, postural hypotension, bradycardia

Other
Euphoria, miosis

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. Pain of unknown etiology.
3. Multiple trauma.
4. Concomitant use of CNS depressant drugs or medications.
5. When CNS status requires patient be closely monitored.
6. Convulsive disorders.

CONTRAINDICATION(S):

1. Hypotension (below 100 systolic).
2. Respiratory depression.
3. Acute exacerbation of asthma or COPD.
4. Hypersensitivity.
5. MAO inhibitor use within 14 days.

ROUTE(S) OF ADMINISTRATION:

IV; IM

ADULT DOSAGE:

25-50 mg slow IV push q 2-4 hrs prn
50-100 mg IM q 2-4 hrs prn

PEDIATRIC DOSAGE:

1 mg/kg IV/IM

SUPPLIED FORM(S):

Ampule: 50 mg/mL
75 mg/mL
100 ml/mL

ADDITIONAL INFORMATION:

1. Have naloxone and resuscitation equipment available.
2. Commonly given with an antiemetic such as dimenhydrinate (Gravol).

methylprednisolone **Solu-Medrol**

CLASSIFICATION(S):
Steroid; Glucocorticoid

INDICATION(S):
1. Severe allergic reactions/anaphylaxis.
2. Acute exacerbation of asthma/COPD.

THERAPEUTIC ACTION(S):
1. Corticosteroids diffuse across cell membranes and complex with specific cytoplasmic receptors. These complexes then enter the cell nucleus, bind to DNA, and stimulate transcription of messenger RNA (mRNA) and subsequent protein synthesis of various enzymes thought to be ultimately responsible for two categories of effects of systemic corticosteroids (anti-inflammatory, and immunosuppressant).
2. Decreases or prevents tissue responses to inflammatory processes, thereby reducing development of symptoms of inflammation without affecting the underlying cause. Inhibits accumulation of inflammatory cells, including macrophages and leukocytes, lysosomal enzyme release, and synthesis and/or release of several chemical mediators of inflammation.

ADVERSE EFFECT(S):
There are no significant side effects associated with a single dose when utilized in emergencies. Most adverse effects are seen over long-term use.

CNS
Headache, confusion, vertigo

CVS
Hypertension, CHF, edema

GI
N/V, GI hemorrhage , abdominal distension

Fluid & Electrolyte
Hypokalemia, sodium retention, fluid retention

Other
Muscle weakness, hyperglycemia

PRECAUTION(S):

1. Renal and hepatic insufficiency.
2. AMI, CHF.
3. Hypertension.
4. Diabetes.
5. Immunosuppressed patients.
6. Convulsive disorders.

CONTRAINDICATION(S):

None when used in the emergency setting.

ROUTE(S) OF ADMINISTRATION:

IM; IV

ADULT DOSAGE:

125-250 mg slow IV push or IM q 4-6 hrs prn

PEDIATRIC DOSAGE:

1-2 mg/kg slow IV push/IM, max 125 mg

SUPPLIED FORM(S):

Vial: 40 mg/vial
125 mg/vial
500 mg/vial
1 g/vial

ADDITIONAL INFORMATION:

1. Once reconstituted, use within 48 hours.
2. Pediatric patients who've recently been exposed to chicken pox or who currently have a disease, should not receive any steroids, as the administration of steroids in this setting may alter the immune response and result in severe disease or death.
3. Onset of action is two to six hours.
4. Increased response to sympathetic agents.

metoclopramide **Maxeran; Reglan**

CLASSIFICATION(S):
Antiemetic; Modifier of Upper GI Tract Motility

INDICATION(S):
1. Treatment of nausea and vomiting.
2. Treatment of migraine headaches in combination with dihydroergotamine (DHE).

THERAPEUTIC ACTION(S):
1. Antagonizes central and peripheral dopamine receptors, which raises the threshold of activity in the chemoreceptor trigger zone, resulting in antiemetic effects.
2. Increases the amplitude and tone of gastric contractions, increases peristalsis and causes accelerated gastric emptying, and intestinal transit.
3. Maxeran is used to counteract the gastric stasis and nausea associated with migraine and to promote the absorption of orally administered analgesics given in the treatment of migraine.

ADVERSE EFFECT(S):

CNS
Drowsiness, fatigue, headache, dizziness, seizures

CVS
Hypertension, tachydysrhythmias

GI
Diarrhea, urinary frequency

Other
Extrapyramidal reactions (occur more frequently at higher dosages)

PRECAUTION(S):
1. Hx of epilepsy or Parkinson's disease (potential for exacerbation of their conditions).
2. Anticholinergic drugs antagonize the effects of Maxeran on GI motility.
3. Sedative effects of the drug can be potentiated by other CNS depressants.
4. MAO inhibitor, use within 14 days.

CONTRAINDICATION(S):
1. Hypersensitivity.
2. GI hemorrhage, mechanical obstruction or perforation.

3. In patients with pheochromocytoma, IV administration of metoclorpramide may cause hypertensive crisis.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
0.1 mg/kg IM or IV push (usual dose is **10 mg**), q 4-6 hours

PEDIATRIC DOSAGE:
0.15 mg/kg IM/IV to a max of 10 mg

SUPPLIED FORM(S):
Vial: 10 mg/2 mL (5 mg/mL)

ADDITIONAL INFORMATION:
1. May also be used to treat gastroesophageal reflux.
2. Do not give through the same line as furosemide.
3. Works best in treating N/V relating to gastroenteritis, biliary colic, head injury and migraine headaches. Not as effective in treating N/V associated with vertigo.

metoprolol **Lopressor; Betaloc**

CLASSIFICATION(S):
Beta–Adrenergic Receptor Blocking Agent

INDICATION(S):
1. To reduce $Beta_1$ effects in acute myocardial infarction (decreases myocardial workload and oxygen demand).
2. Rate control in SVT, PSVT, A-Fib, and A-Flutter.
3. Unstable Angina.
4. Emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

THERAPEUTIC ACTION(S):
1. $Beta_1$ receptor blockade resulting in negative chronotropic, inotropic, and dromotropic response. The end result is a decrease in myocardial oxygen consumption and workload.
2. Blocks the agonistic effects of the sympathetic neurotransmitters by competing for receptor binding sites.
3. Inhibits $Beta_2$ receptors at higher doses.

ADVERSE EFFECT(S):

CNS
Fatigue, dizziness, headache, lightheadedness

RESP
Bronchospasm, dyspnea

CVS
Bradycardia, 2^{nd} & 3^{rd} degree blocks, hypotension, CHF

GI
N/V

PRECAUTION(S):
1. Beta blocker use in diabetic and shock patients may mask catecholamine-induced signs and symptoms of acute hypoglycemia, and hypovolemia.
2. May impair recovery from hypoglycemia in diabetics because they block the effects of catecholamines that promote glycogenolysis, and mobilize glucose in response to hypoglycemia.
3. Liver and renal insufficiency.

4. Administration of epinephrine for allergic and anaphylactic reactions to patients taking beta blockers may result in a hypertensive crisis. In these cases, the beta effects of epinephrine are blocked, allowing the vasoconstrictive alpha properties to take effect.
5. Geriatric patients may be extremely sensitive to a drop in HR and BP.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Sinus bradycardia, sick sinus syndrome, second and third degree heart blocks
3. Right ventricular failure secondary to pulmonary hypertension.
4. Cardiogenic shock.
5. CHF.
6. Bronchospastic disease (asthma, COPD, emphysema, chronic bronchitis).
7. MI patients:
    - HR < 60 beats/minute
    - Heart blocks > first degree
    - Systolic BP < 100 mmHg
8. Concomitant use of calcium channel blockers (wait several hours), including patients on oral calcium channel blockers (may cause severe hypotension).
9. Drug-induced tachycardia (especially cocaine).
10. Drug-induced hypertension.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

5 mg slow IV push (2-5 minutes) repeat q 5 minutes to a max of 15 mg

PEDIATRIC DOSAGE:

Not applicable.

SUPPLIED FORM(S):

Ampule: 5 mg/5 mL (1 mg/mL)

ADDITIONAL INFORMATION:

1. Monitor vital signs, ECG and clinical response.
2. Avoid HR < 60 beats/minute, BP < 100 mmHg and observe ECG for bradycardia or second and third degree heart blocks.

3. Best results seen if the drug is given within two hours from the onset of signs and symptoms of AMI.
4. Concurrent administration with amiodarone may result in additive depressant effects on conduction and negative inotropic effects.
5. In drug-induced hypertension, beta blockers may only block beta receptors, leaving unopposed alpha-adrenergic stimulation and worsening hypertension. Hypertension is often short-lived so aggressive therapy for drug-induced hypertensive emergencies is rarely needed and may contribute to worsening hypotension after the hypertension resolves. Benzodiazepines are the first drug of choice for the treatment of sympathomimetic OD (i.e. cocaine).
6. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.

CLASSIFICATION(S):
Sedative (benzodiazepine); Hypnotic; Amnesic

INDICATION(S):
1. Sedation prior to cardioversion or pacing.
2. Sedation for assisting with endotracheal intubation (RSI/RSS).
3. To maintain sedation, post intubation.
4. Anticonvulsant therapy.
5. Combative or violent patients.
6. Musculoskeletal injuries in combination with analgesics.
7. Cocaine overdose.

THERAPEUTIC ACTION(S):
1. Reduces the ability of the neuron to depolarize to the threshold required to produce an action potential. Thus, the seizure threshold is raised.
2. Suppresses the spread of seizure activity produced by epileptogenic foci in the cortex, thalamus, and limbic structures but does not abolish the abnormal discharge of the focus.
3. Potentiates gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter. Activation of the GABA receptor results in the opening of the chloride channel, allowing the flow of chloride ions into the neuron. In turn, this results in hyperpolarization and that inhibits firing of the neuron, translating into decreased neuronal excitability, thus attenuating the effects of subsequent depolarizing excitatory transmitters.
4. Decreases seizure activity by enhanced presynaptic inhibition.
5. Produces skeletal muscle relaxation primarily by inhibiting spinal polysynaptic afferent pathways. May also directly depress motor nerve and muscle function.
6. Midazolam also has anxiolytic, hypnotic, and anterograde amnestic effects.
7. Has a relatively high *affinity* (about twice that of diazepam) for the benzodiazepine receptor.
8. Peak serum concentration achieved with IM administration is about half that achieved with an IV dose.
9. Onset of action: IM – within 15 minutes, IV – 1.5-5 minutes.

ADVERSE EFFECT(S):

CNS
Headache, drowsiness, sedation, retrograde amnesia

RESP
Respiratory depression, apnea, laryngospasm, bronchospasm

CVS
Hypotension, bradycardia, arrhythmias

Other
Blurred vision, nystagmus, pinpoint pupils

PRECAUTION(S):
1. Elderly patients (decrease dosage).
2. Renal and hepatic impairment.
3. Patients, with COPD, experience prolonged sedation and respiratory depression.
4. CHF patients have prolonged elimination of the drug.
5. Hypotension.

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
Sedation/Pain Management
0.05 mg/kg slow IV push, titrated to effect or **2.5 mg**, max 5 mg. Wait 2 minutes between doses

RSI/Seizures
0.05-0.1 mg/kg slow IV push, max **5 mg/dose**. Repeat q 5-10 minutes prn

0.2 mg/kg IM to a max of 10 mg

Combative Patients
2.5 mg slow IV push
5 mg IM

Cocaine Overdose
2.5-5 mg IV/IM titrated to effect

For IV administration, mix the drug with NS to a total of 10 mL to allow for slow titration of the drug.

PEDIATRIC DOSAGE:

0.05-0.2 mg/kg slow IV push titrated to effect, max single dose **2.5 mg**, max total dose 5 mg
0.2 mg/kg IM, max 5 mg
0.2-0.3 mg/kg intranasal, max 5 mg

SUPPLIED FORM(S):

Vial: 1, 2 and 10 mL (5 mg/mL)
2, 5, and 10 mL (1 mg/mL)

ADDITIONAL INFORMATION:

1. The cardiovascular effects of midazolam appear to be minimal. Cardiac hemodynamic studies have shown midazolam to cause a slight to moderate decrease in mean arterial pressure, cardiac output, stroke volume, and systemic vascular resistance.
2. Have resuscitation equipment and flumazenil available.
3. Do not administer through the same line as phenytoin (precipitate may form).

morphine

CLASSIFICATION(S):
Narcotic (Opiate); Analgesic

INDICATION(S):
1. Ischemic chest pain in combination with nitroglycerine.
2. Severe pain.
3. Acute pulmonary edema, secondary to left ventricular failure.

THERAPEUTIC ACTION(S):
1. It has been proposed that there are multiple subtypes of opioid receptors, each mediating various therapeutic and/or side effects of opioid drugs. The actions of an opioid analgesic may therefore depend upon its binding affinity for each type of receptor and on whether it acts as a full agonist, partial agonist or is inactive at each type of receptor.
2. Opioid analgesics bind with stereospecific receptors at many sites within the CNS to alter processes effecting both the perception of pain and the emotional response to pain.
3. Analgesia (exerts its main effect by acting as an opioid agonist at specific opioid receptor sites in the CNS and other tissues). Maximum analgesia occurs 20 minutes after IV administration and 30-60 minutes after IM injection. Analgesia persists for 2.5-7 hours.
4. Vasodilation increases venous capacity and decreases myocardial O_2 requirements through peripheral venous pooling (decreased preload) and by reducing systemic vascular resistance (decreased afterload).

ADVERSE EFFECT(S):

CNS
Sedation, euphoria, lethargy

RESP
Respiratory depression, apnea

CVS
Hypotension, bradycardia, palpitations

GI
N/V, biliary tract spasm, urethral spasm (urinary retention)

Other
Miosis

morphine

PRECAUTION(S):

1. Hepatic or renal insufficiency.
2. Pain of unknown etiology.
3. Multiple trauma.
4. Concomitant use of CNS depressant drugs or medications.
5. Gallbladder/biliary disease (may cause biliary contraction).
6. Recent GI or GU surgery.
7. Head injury.
8. Convulsive disorders.

CONTRAINDICATION(S):

1. Hypotension.
2. Respiratory depression, except pulmonary edema.
3. Acute exacerbation of asthma or COPD.
4. Hypersensitivity.
5. MAO inhibitor use within 14 days.

ROUTE(S) OF ADMINISTRATION:

IV; IM

ADULT DOSAGE:

Severe Pain

2.5-5 mg slow IV push over 1-2 minutes q 5 minutes prn, max 30 mg
5-10 mg IM q 4-6 hrs prn

Chest Pain/Pulmonary Edema

2-4 mg slow IV push over 1-2 minutes q 5 minutes prn

PEDIATRIC DOSAGE:

0.1 mg/kg slow IV push, max single dose 2.5 mg
0.1 mg/kg IM, max single dose 5 mg

SUPPLIED FORM(S):

Ampule: 10 mg/mL

ADDITIONAL INFORMATION:

1. Have naloxone and resuscitation equipment available.
2. Commonly given with an antiemetic.

nalbuphine hydrochloride **Nubain**

CLASSIFICATION(S):
Narcotic Agonist-Antagonist Analgesic

INDICATION(S):
1. Moderate to severe pain.
2. Obstetrical analgesic during labour.

THERAPEUTIC ACTION(S):
1. It has been proposed that there are multiple subtypes of opioid receptors, each mediating various therapeutic and/or side effects of opioid drugs. The actions of an opioid analgesic may therefore depend upon its binding *affinity* for each type of receptor, and on whether it acts as a full agonist, partial agonist or is inactive at each type of receptor.
2. Opioid analgesics bind with stereospecific receptors at many sites within the CNS to alter processes effecting both the perception of pain and the emotional response to pain. Analgesia exerts its main effect by acting as an opioid agonist at specific opioid receptor sites in the CNS and other tissues.
3. Similar analgesic potency of morphine.

ADVERSE EFFECT(S):

CNS
Sedation, vertigo, confusion

RESP
Respiratory depression, dyspnea, bronchospasm

CVS
Hypotension, bradycardia

GI
N/V

PRECAUTION(S):
1. Hepatic or renal insufficiency.
2. Pain of unknown etiology.
3. Multiple trauma.
4. Head injury.
5. Concomitant use of CNS depressant drugs or medications.

CONTRAINDICATION(S):

1. Nalbuphine or sulfite allergy.
2. Hypotension.
3. Respiratory depression.
4. Acute exacerbation of asthma or COPD.
5. MAO inhibitor use within 14 days.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
10-20 mg slow IV, IM or SC q 3-6 hrs prn, max 160 mg/day

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Vial: 10, 20 mg/mL

ADDITIONAL INFORMATION:
Closely monitor CNS status.

CLASSIFICATION(S):
Narcotic Antagonist

INDICATION(S):
1. Respiratory and neurologic depression, induced by opiate intoxication unresponsive to oxygen and hyperventilation.
2. Decreased LOC or coma of unknown etiology, believed to be induced by narcotics.

THERAPEUTIC ACTION(S):
There are multiple subtypes of opioid receptors within the CNS, each mediating different therapeutic and/or side effects of opioid drugs. Two of these types of receptors (mu and kappa) mediate analgesia as well as side effects. A third type of receptor (sigma) may not mediate analgesia; actions at this receptor may produce the subjective and psychotomimetic effects characteristic of opioids with mixed agonist/antagonist activity (i.e. nalbuphine). Naloxone displaces previously administered opioid analgesics from all of these types of receptors and competitively inhibits their actions.

ADVERSE EFFECT(S):

CNS
Seizures, dizziness, headache, tremulousness

CVS
Tachycardia, hypotension, hypertension, cardiac arrest

GI
N/V
Most side effects related to the reversal of narcotic depression.

PRECAUTION(S):
1. May induce acute withdrawal symptoms in narcotic dependent patients.
2. Duration of Narcan (naloxone) is shorter in narcotic dependent patients.

CONTRAINDICATION(S):
Nothing significant.

ROUTE(S) OF ADMINISTRATION:
IV; ETT; IM; IL; SC

ADULT DOSAGE:
0.4-2 mg slow IV push q 2-3 minutes prn, 2 mg IM/SC

If no improvement in respiratory effort and LOC is seen after administration of 10 mg - consider another cause.

PEDIATRIC DOSAGE:
0.1 mg/kg slow IV/IM/SC q 2-3 minutes prn, max 2 mg/dose

SUPPLIED FORM(S):
Ampule: 2 mg/2mL
0.4 mg/mL
Multidose Vial: 4 mg/10 mL (0.4 mg/mL)

ADDITIONAL INFORMATION:
1. It is preferred to improve respirations and BP but not to wake the patient up prehospitally (potential for aspiration).
2. If sedation is reversed within the prehospital setting, be prepared for a potentially combative, aggressive or seizing patient. If the patient's vital signs are stable, defer use until arrival within the ER.

CLASSIFICATION(S):
Parasympathomimetic

INDICATION(S):
Reversal of nondepolarizing neuromuscular blocking agents.

THERAPEUTIC ACTION(S):
1. Inhibits the destruction of acetylcholine by cholinesterase, thereby increasing the transmission of nerve impulses across the neuromuscular junction.
2. Increases cholinergic response (*SLUDGE*).*
3. Onset of action is four to eight minutes; peak effect at 30 minutes.

ADVERSE EFFECT(S):
CNS
Seizures, drowsiness

RESP
Respiratory arrest, bronchospasm

CVS
Cardiac arrest, bradycardia, heart block

Other
*SLUDGE**: S**alivation, **L**acrimation, **U**rination, **D**efecation, **G**astrointestinal cramping, **E**mesis (muscle cramps, fasciculation and weakness)

PRECAUTION(S):
1. Administer atropine 0.5-1 mg prior to reversal of the nondepolarizing neuromuscular blocking agent to avoid excessive *sludge* effects, and bradycardia.
2. Asthma.
3. Epilepsy.
4. Bradydysrhythmias.
5. Recent AMI.

CONTRAINDICATION(S):
1. Hypersensitivity.
2. Bronchial asthma.
3. Intestinal/urinary tract obstructions.
4. Peritonitis.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
0.5-2 mg slow IV push with **0.5-1 mg** of atropine

PEDIATRIC DOSAGE:
0.02 mg/kg IV with **0.02 mg/kg** of atropine

SUPPLIED FORM(S):
Ampule: Prostigmin 1:2000; 0.5 mg/mL
Vial: Prostigmin 1:2000; 0.5 mg/mL (10 mL)
Prostigmin 1:1000; 1 mg/mL (10 mL)
Prostigmin 1:400; 2.5 mg/mL (5 mL)

ADDITIONAL INFORMATION:
1. Reversal of a nondepolarizing neuromuscular blocking agent should not be attempted until some movement is noted or a peripheral nerve stimulator is used to demonstrate return of function.
2. Return of muscular movement is usually noted approximately 30-60 minutes after initial flaccid paralysis.

CLASSIFICATION(S):
Antianginal; Vasodilator

INDICATION(S):
1. ACS.
2. Ischemic chest pain, AMI, angina.
3. CHF/pulmonary edema.
4. Hypertension associated with ACS.

THERAPEUTIC ACTION(S):
1. Vasodilation (relaxes vascular smooth muscle) decreasing preload and afterload - results in decreased myocardial workload.
2. Increases use of coronary collaterals to enhance myocardial perfusion.
3. Relieves coronary vasospasm.
4. Dilates coronary arteries.

ADVERSE EFFECT(S):

CNS
Headache, dizziness, weakness

CVS
Hypotension, reflex tachycardia, palpitations, flushing, bradycardia

GI
N/V, abdominal pain

PRECAUTION(S):
1. Administer drug in semi-fowlers position if possible.
2. Limit use/discontinue if systolic blood pressure drops by 10 percent in normotensive patients, or 30 percent in hypertensive patients.
3. Have IV in place prior to administration.
4. Inferior MI patients (potential for right ventricular involvement).

CONTRAINDICATION(S):
1. Hypotension.
2. Hypovolemia.
3. Viagra use within 24 hours.
4. Severe bradycardia/tachycardia.

ROUTE(S) OF ADMINISTRATION:
SL

ADULT DOSAGE:
Chest Pain
1 Tablet **(0.3-0.6 mg)** q 5 minutes prn, max 2 mg or BP < 100 systolic
1 Aerosol spray **(0.4 mg)** q 5 minutes prn, max 2 mg or BP < 100 systolic

Pulmonary Edema
Same as chest pain dosage, max 2.4 mg

PEDIATRIC DOSAGE:
Not applicable.

SUPPLIED FORM(S):
Tablet: 0.3-0.6 mg (100 tablet per bottle)
Spray: 0.4 mg (200 metered doses per bottle)

ADDITIONAL INFORMATION:
1. Should sustained hypotension or bradycardia occur as a result of nitroglycerin administration, discontinue use and attempt to resolve the hypotension or bradycardia (fluid bolus, atropine, inotropic agents) as indicated. If hypotension and/or bradycardia resolve, risk-to-benefit must be cautiously weighed when considering further administration of nitrates.
2. Effects potentiated by other vasodilators.

CLASSIFICATION(S):
Antianginal; Vasodilator; Antihypertensive

INDICATION(S):
1. Unstable angina/AMI (consider if chest pain persists despite nitroglycerin 0.4 mg SL X 3) – ACS.
2. CHF.
3. Acute pulmonary edema with an accompanying hypertensive emergency.

THERAPEUTIC ACTION(S):
1. Vasodilation (relaxes vascular smooth muscle) decreases preload and afterload, resulting in decreased myocardial workload.
2. Increases use of coronary collaterals to enhance myocardial perfusion.
3. Relieves coronary vasospasm.
4. Dilates coronary arteries.

Low doses (30-40 μg/minute) produces venodilation.
High doses (150-500 μg/minute) produces arterial dilation.

ADVERSE EFFECT(S):

CNS
Headache, dizziness, weakness

CVS
Hypotension, reflex tachycardia, palpitations, flushing, bradycardia

GI
N/V, abdominal pain

PRECAUTION(S):
1. Special tubing (isosorb tubing) is required as standard PVC tubing absorbs up to 80 percent of diluted nitroglycerin.
2. HR and BP must be monitored q five minutes during titration of nitroglycerine, once stable and pain free repeat q 15 minutes.
3. Withdraw nitroglycerin slowly by 5-10 μg/minute q 5-10 minutes, as abrupt cessation could result in myocardial ischemia or hypertension.
4. Headache usually improves with analgesics, use slightly lower doses over time.
5. IV infusion pump is mandatory.

6. Reduce dose/discontinue if systolic blood pressure drops by 10 percent in normotensive patients, 30 percent in hypertensive patients, or BP < 90 mmHg.
7. Inferior MI patients with right ventricular involvement.

CONTRAINDICATION(S):

1. Hypotension.
2. Hypovolemia.
3. Viagra use within 24 hours.
4. Severe bradycardia/tachycardia.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

Initially **5-10 µg/minute**, increase by **5-10 µg/minute** q 5-10 minutes until desired hemodynamic or clinical response is achieved.

Most patients respond to 50-200 µg/minutes with minimal improvement seen over 300 µg/minute.

PEDIATRIC DOSAGE:

Not applicable.

SUPPLIED FORM(S):

Premixed glass bottle: 24, 50, 100 mg/250 mL
Glass ampule or vial: 5 mg/10 mL

ADDITIONAL INFORMATION:

1. Keep medication sheltered and out of sunlight.
2. Should sustained hypotension occur as a result of nitroglycerin administration, discontinue or limit use and attempt to resolve the hypotension as indicated (decrease the dose, fluid bolus, inotropic agents). If hypotension resolves, risk-to-benefit must be cautiously weighed when considering further administration of nitrates.
3. Special nitroglycerin sets made of non-PVC plastic cause minimal absorption; therefore, nearly all of the calculated dose will be delivered to the patient. When these sets are used, dosage instructions should be followed with care, as changing from a standard set (PVC) to a special set (non-PVC) may result in excessive nitroglycerin dosage unless allowances are made to the difference in the amount of nitroglycerin actually delivered to the patient.

nitrous oxide **Entonox; Nitronox**

CLASSIFICATION(S):
Gaseous Analgesic

INDICATION(S):
Temporary relief of mild to moderate pain.

THERAPEUTIC ACTION(S):
1. Rapid reversible CNS depression and analgesia.
2. Inhaled anesthetics act on the lipid matrix of neuronal membranes or other lipophilic sites. This changes the membrane thickness, which in turn effects the gating properties of ion channels in neurons.

ADVERSE EFFECT(S):

CNS
Drowsiness, dizziness, lightheadedness, numbness/tingling, headache

GI
N/V

PRECAUTION(S):
1. Store and administer with cylinder horizontal.
2. Anytime when over 50 percent oxygen is required.
3. Severe maxillofacial injury (use mouthpiece).
4. Use in ventilated areas.
5. Gases may separate at – six degrees Celsius resulting in improper device operation.

CONTRAINDICATION(S):
1. Decreased LOC.
2. Thoracic trauma with potential or actual pneumothorax (N_2O collects in dead air spaces and may increase pneumothorax.)
3. COPD.
4. Acute pulmonary edem.a
5. Decompression sickness (the bends), nitrogen narcosis, air emboli, air transport (expands air pockets).
6. Abdominal pain NYD/abdominal trauma.
7. Bowel obstruction.
8. Hypotension/shock.

9. Potential or concomitant use of CNS depressants.
10. Inability to comply with verbal instructions.

ROUTE(S) OF ADMINISTRATION:
Deep inhalation via demand valve and mask.

ADULT DOSAGE:
Self administered (onset, peak and duration two to five minutes).

PEDIATRIC DOSAGE:
Same as adult.

SUPPLIED FORM(S):
Nitronox - two cylinders one containing O_2 the other N_2O. Both cylinders are joined by a valve that regulates flow to provide 50:50 mixture of two gases. Piped to a demand valve.
Entonox - single tank system, with O_2 and N_2O combined in one tank (invert several times before use).

ADDITIONAL INFORMATION:
1. Eliminated unchanged via the lungs in two to five minutes.
2. Provide oxygen therapy after prolonged use, especially in the pediatric patient as hypoxia may result.
3. Especially effective for labour pains.

CLASSIFICATION(S):
Sympathomimetic; Vasopressor

INDICATION(S):
Treatment of severe cardiogenic shock and hemodynamically significant hypotension refractory to other sympathomimetics.

Systolic pressure less than 70 mmHg with serious signs and symptoms of shock.

THERAPEUTIC ACTION(S):
1. Stimulates alpha and $beta_1$ adrenergic receptors in a dose-related fashion. At lower doses (less than two mcg per minute), stimulation of $beta_1$ receptors results in a positive inotropic and chronotropic effect. At higher doses (greater than four mcg per minute), alpha adrenergic effect predominates, resulting in elevated total peripheral resistance. Chronotropy diminishes as a result of baroreceptor-mediated vagal stimulation.
2. Dilates coronary arteries (two and half times the degree of vasodilation over that of epinephrine) resulting in increased coronary blood flow

ADVERSE EFFECT(S):

CNS
Headache, anxiety

CVS
Bradycardia, dysrhythmias (VT), chest pain, hypertension

Other
Ischemic injury to organs and tissue as a result of $Alpha_1$ effects and tissue hypoxia

PRECAUTION(S):
1. Extravasation causes tissue necrosis (use phentolamine to reverse effects).
2. Utilize antecubital vein, while avoiding veins in the hands, ankles or legs.
3. Avoid hypertension.
4. Norepinephrine should be tapered slowly to avoid abrupt and severe hypotension.
5. Caution with elderly patients.
6. Infusion pump is mandatory.
7. Myocardial infarction.

CONTRAINDICATION(S):

1. Hypovolemia.
2. Hypercapnea.
3. Pheochromocytoma.
4. Tachyarrhythmias.
5. Patients taking MOA inhibitors.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

0.5-30 µg/minute. Start at 0.5-1 µg/minute, titrate infusion to achieve desired effects (systolic BP of 90-100 mmHg), max 30 µg/minute

Average adult dose is 2-12 µg/minute

Mix 4 mg/250 mL D_5W or NS = 16 µg/mL

PEDIATRIC DOSAGE:

Not applicable

SUPPLIED FORM(S):

Ampule: 4 mg/4 mL (1 mg/mL)

ADDITIONAL INFORMATION:

1. Check BP q two minutes during titration of norepinephrine. Then check BP q five minutes thereafter once BP is stabilized.
2. Generally, while a norepinephrine infusion is running, a dopamine infusion is maintained at low doses to ensure adequate renal perfusion.
3. Correct hypovolemia before administering.
4. Use with beta blockers may cause hypertensive crisis.
5. Concurrent use with patients taking MAO inhibitors may prolong or intensify cardiac stimulation and vasopressor effects because of the release of catecholamines that accumulate in intraneuronal storage sites, during MAO inhibitor therapy.

oxygen

CLASSIFICATION(S):
Medical Gas

INDICATION(S):
1. Treatment of hypoxemia.
2. Ischemic chest pain.
3. Any patient with respiratory difficulty.
4. Any critically ill patient (shock, head injuries, etc.).
5. Any decreased level of consciousness.

THERAPEUTIC ACTION(S):
1. Increase circulating PO_2.
2. Required for normal cellular metabolism enabling cells to break down glucose into a usable energy form such as adenosine triphosphate (ATP).

ADVERSE EFFECT(S):

RESP
Drying of mucus membranes

PRECAUTION(S):
May induce respiratory depression in patients with an underlying hypoxic drive (COPD). Therefore, begin O_2 administration at low flow rates and increase as necessary (be prepared to assist ventilations if necessary).

Note: *Never* withhold high flow rates if required.

CONTRAINDICATION(S):
None.

ROUTE(S) OF ADMINISTRATION:
Inhalation.

ADULT DOSAGE:
Based on status and method of delivery.

PEDIATRIC DOSAGE:
Same as adult

SUPPLIED FORM(S):

Various sizes of pressurized cylinders:

- D (400 L)
- E (660 L)
- G (1500 L)
- M (3000 L)

ADDITIONAL INFORMATION:

1. When possible use humidified oxygen.
2. Pulse oximetry provides a useful method of titrating oxygen administration.
3. Rely on clinical presentation versus pulse oximetry when administering oxygen.
4. When assessing pulse oximetry be aware of false readings, i.e., carbon monoxide (CO) poisoning.

oxytocin **Syntocinon; Pitocin**

CLASSIFICATION(S):
Oxytocic

INDICATION(S):
1. Postpartum hemorrhage following delivery of the infant and placenta.
2. Induction of labour (in hospital only).

THERAPEUTIC ACTION(S):
Stimulates contraction of uterine smooth muscle by increasing intracellular calcium concentrations, thus mimicking contractions of normal, spontaneous labour and transiently impeding uterine blood flow. Amplitude and duration of uterine contractions are increased, leading to dilation and effacement of the cervix.

ADVERSE EFFECT(S):

CNS
Anxiety

RESP
Dyspnea

CVS
Hypotension, tachycardia, hypertension, dysrhythmias, chest pain

Other
Uterine rupture

PRECAUTION(S):
1. History of cesarean section or uterine surgery.
2. May cause placental retention if given before delivery of the placenta

CONTRAINDICATION(S):
1. Presence of second fetus
2. Hypersensitivity.
3. No use prior to delivery of the baby in the prehospital setting.

ROUTE(S) OF ADMINISTRATION:
IV infusion/IM

oxytocin **Syntocinon; Pitocin**

ADULT DOSAGE:
20 units IV infusion in 1000 mL NS titrated to uterine response and severity of bleeding.
10 units IM

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Ampule: 10 units/mL

ADDITIONAL INFORMATION:
1. Used in conjunction with:
    - Uterine massage
    - Fluid replacement
    - Placing baby to the breast for suckling
2. Commonly used in hospital to induce labour contractions.

pancuronium **Pavulon**

CLASSIFICATION(S):
Nondepolarizing Neuromuscular Blocking Agent

INDICATION(S):
1. To provide skeletal muscle relaxation and paralysis to facilitate endotracheal intubation.
2. Situations include an unprotected airway or respiratory failure in the following conditions:
    - Head injury.
    - Drug overdose.
    - Status epilepticus.
    - Agitated or combative patients.
    - Trismus.
    - Multiple trauma.
    - Severe respiratory distress.

THERAPEUTIC ACTION(S):
1. Competes against acetylcholine for cholinergic receptors at the motor end-plate. Once bound to receptors, no response is produced, which results in absence of muscle fasciculation before flaccid paralysis.
2. Onset of action is two to five minutes with duration of action lasting 45-90 minutes.
3. Pancuronium has no effect on consciousness, pain threshold or the cognitive activity of the brain.

ADVERSE EFFECT(S):

RESP
Bronchospasm, laryngospasm

CVS
Tachycardia, elevation of arterial blood pressure and cardiac output, decreased venous pressure

PRECAUTION(S):
1. Cardiovascular, hepatic or renal insufficiency.
2. Does not stop neuronal seizure activity (which may be undetectable in a paralyzed patient).
3. Possibility for a difficult intubation (i.e., obesity).

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Any situation where tachycardia may be undesirable.
3. Inadequate airway control.
4. Upper airway obstruction (partial or complete).

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Standard dose

0.04-0.1 mg/kg IV push, repeat 0.01 mg/kg q 25-60 minutes

Defasciculating Dose

0.01 mg/kg IV push

PEDIATRIC DOSAGE:

Same as adult.

SUPPLIED FORM(S):

Ampules: 2 mg/mL, 2 and 5 mL

ADDITIONAL INFORMATION:

1. Chronic use of antiepileptic agents such as carbamazepine (Tegretol) or phenytoin (Dilantin) may shorten the length of neuromuscular blockade.
2. Pancuronium is about one third less potent than vecuronium.
3. Pancuronium should not be administered before sedation is induced.
4. May be reversed by neostigmine, as this agent possesses anticholinesterase activity allowing levels of acetylcholine to rise at the postsynaptic receptor.
5. Reversal of a nondepolarizing neuromuscular blocking agent should not be attempted until some movement is noted, or a peripheral nerve stimulator is used to demonstrate return of function.
6. Return of muscular movement is usually noted approximately 30-60 minutes after initial flaccid paralysis.

CLASSIFICATION(S):
Plasma Volume Expander

INDICATION(S):
When plasma volume expansion is desired as an adjunct in the management of shock due to hemorrhage, surgery, sepsis, burns or other trauma.

THERAPEUTIC ACTION(S):
Expands plasma volume in excess of the volume infused. This expansion persists for approximately 18 to 24 hours and is expected to improve the hemodynamic status for 12 to 18 hours.

ADVERSE EFFECT(S):

CNS
Nausea, headache, weakness, fatigue, dizziness, anxiety

CVS
Tachycardia, coagulation disorders, fever, chills

PRECAUTION(S):
1. Not a substitute for red blood cells or coagulation factors in plasma.
2. Potential for circulatory overload.
3. Special care should be exercised in patients who have impaired renal function since this is the principal route by which pentastarch is eliminated.

CONTRAINDICATION(S):
1. Hypersensitivity to hydroxyethyl starch.
2. Bleeding disorders.
3. CHF.
4. Renal disease with oliguria or anuria not related to hypovolemia.
5. Pregnancy.

ROUTE(S) OF ADMINISTRATION:
IV infusion

ADULT DOSAGE:
500-1000 mL bolus (in acute hemorrhagic shock, an administration rate approaching 20 mL/kg/hr may be used)

PEDIATRIC DOSAGE:
Not recommended.

SUPPLIED FORM(S):
Bag: 500 mL

ADDITIONAL INFORMATION:
Titrate to a BP of 90-100 mmHg systolic.

phenobarbitol **Luminal**

CLASSIFICATION(S):
Anticonvulsant; Hypnotic; Sedative; Barbiturate

INDICATION(S):
1. Treatment of status epilepticus refractory to standard treatment.
2. Specifically, phenobarbitol is indicated for control of generalized tonic-clonic and cortical focal seizures.

THERAPEUTIC ACTION(S):
1. Reduces CNS synaptic transmission by enhancing and/or mimicking the action of gamma-aminobutyric acid (GABA), which is an inhibitory neurotransmitter.
2. Increases the threshold for electrical stimulation of the motor cortex.

ADVERSE EFFECT(S):

CNS
Drowsiness, dizziness, headache, residual sedation

RESP
Respiratory depression, apnea, bronchospasm

CVS
Hypotension (related to speed of administration), bradycardia

GI
N/V, diarrhea, constipation

PRECAUTION(S):
1. Use cautiously in patients with Hx of drug dependence/abuse.
2. Rapid IV injection can result in respiratory depression and hypotension.
3. Due to the drug's high alkaline content, drug extravasation may result in tissue necrosis.

CONTRAINDICATION(S):
1. Hypersensitivity.
2. Hepatic and renal insufficiency.
3. Severe respiratory distress.
4. Nephritis.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
Status Epilepticus
10-20 mg/kg slow IV push until seizure stops or a total dosage of 1-2 g; rate of infusion should not exceed 50 mg/minute

PEDIATRIC DOSAGE:
10 mg/kg slow IV push, repeat q 15-30 minutes at 5 mg/kg, max 40 mg/kg

SUPPLIED FORM(S):
Ampule: 30 mg/mL
120 mg/mL

ADDITIONAL INFORMATION:
Monitor ECG during drug administration.

phentolamine **Rogitine**

CLASSIFICATION(S):
Alpha Adrenergic Blocker

INDICATION(S):
Prevention of dermal necrosis and sloughing following extravasation of alpha adrenergic drugs such as norepinephrine, epinephrine, dobutamine and dopamine.

THERAPEUTIC ACTION(S):
1. Short duration alpha adrenergic blockade ($alpha_1$ and $alpha_2$ receptors) and antagonism of effects of circulating epinephrine and norepinephrine. Causes vasodilation and reduction in peripheral resistance; IV duration 10-15 minutes; IM duration three to four hours.
2. Produces positive inotropic and chronotropic effects on cardiac muscle and vasodilation in vascular smooth muscle.
3. Reverses vasoconstrictive effects of norepinephrine and dopamine.

ADVERSE EFFECT(S):

CNS
Dizziness, weakness, flushing, cerebrovascular spasm

CVS
Hypotension, tachycardia, angina, dysrhythmias, AMI

GI
N/V, diarrhea, dry mouth, abdominal pain

PRECAUTION(S):
1. Patients with Hx of gastritis or peptic ulcers (phentolamine increases gastric secretions).
2. Renal insufficiency (primarily excreted by the kidneys).

CONTRAINDICATION(S):
1. Hypersensitivity.
2. Coronary artery disease (AMI or angina).
3. Hypotension.

ROUTE(S) OF ADMINISTRATION:
IV/IM

ADULT DOSAGE:
5-10 mg diluted in 10 mL NS; infiltrate area where alpha-adrenergic drug has extravasated (blanching will resolve within one hour if drug is successful)

PEDIATRIC DOSAGE:
Same as adult.

SUPPLIED FORM(S):

Vial: 5 mg in powder form

ADDITIONAL INFORMATION:
Dilute powder form with NS.

phenytoin **Dilantin**

CLASSIFICATION(S):
Anticonvulsant

INDICATION(S):
Treatment of status epilepticus refractory to benzodiazepines.

THERAPEUTIC ACTION(S):
1. Stabilizes neuronal membranes at the cell body, axon, and synapse and limits the spread of neuronal or seizure activity. In neurons, phenytoin decreases sodium and calcium ion influx by prolonging voltage-dependent channel inactivation time during generation of nerve impulses. Phenytoin blocks the voltage-dependent sodium channels of neurons and inhibits calcium flux across neuronal membranes, thus helping to stabilize neurons.
2. Phenytoin shortens the refractory period, thereby shorteninig the QT interval and the duration of the action potential.
3. Antiarrhythmic effects act be normalizing the influx of sodium and calcium to cardiac purkinje fibers. Abnormal ventricular automaticity and membrane responsiveness are decreased.

ADVERSE EFFECT(S):

CNS
CNS depression, nystagmus, headache, ataxia

RESP
Respiratory depression

CVS
Hypotension, dysrhythmias (bradycardia, heart block, VF)

PRECAUTION(S):
1. Extravasation may result in tissue necrosis.
2. Avoid use in glucose containing solutions (use NS only.)
3. Cardiovascular, hepatic or renal insufficiency.
4. Hypotension.
5. Consider consulting with a physician prior to IV-Dilantin administration in patients on daily oral Dilantin (this drug may be an ineffective anticonvulsant for this patient; or blood levels may need to be assessed before a loading dose of Ddilantin is administered).

CONTRAINDICATION(S):

1. Hypersensitivity to hydantoins.
2. Bradycardia.
3. Heart blocks.
4. Hypoglycemic seizures (Use $D_{50}W$).
5. Dysrhythmias (except those due to digitalis toxicity).
6. Adams-stokes syndrome.

ROUTE(S) OF ADMINISTRATION:

IV infusions

ADULT DOSAGE:

10-15 mg/kg at < 50 mg/minute

Infusion prepared by adding the selected dose to produce a total of 50 mL NS infused at 100 mL/hour (infusion pump), 100 gtts/minute (60 drop set).

PEDIATRIC DOSAGE:

15 mg/kg at a rate of < 1 mg/kg/minute

Infusion prepared same as adult.

SUPPLIED FORM(S):

Ampule: 100 mg/2 mL (50 mg/mL)
250 mg/5 mL (50 mg/mL)

ADDITIONAL INFORMATION:

1. Digitalis induced ventricular arrhythmias normally respond to simple administration of potassium, magnesium, and normal saline. Lidocaine however remains the antiarrhythmic of choice if ventricular arrhythmias persist after initial therapy is unsuccessful.
2. May be used as an antidysrhythmic for ventricular arrhythmias associated with digitalis toxicity at 50-100 mg IV q five minutes until the arrhythmia is terminated or max of 15 mg/kg is given.
3. Narrow therapeutic range. Early signs and symptoms of overdose include nystagmus (constant involountary, cyclical movement of the eyeball), ataxia (failure of muscular coordination), slurred speech and tremors.
4. May take 15-20 minutes to control seizures due to rate of infusion.
5. Monitor ECG during administration.
6. Chronic alcohol use may decrease phenytoin levels.

potassium chloride (KCl) **Slow-K; K-Dur**

CLASSIFICATION(S):
Electrolyte

INDICATION(S):
Hypokalemia.

THERAPEUTIC ACTION(S):
1. Replaces lost potassium.
2. Potassium along with sodium is necessary for the conduction of nerve impulses in such specialized tissues as the heart, brain and skeletal muscle, and for the maintenance of normal renal function and acid-base balance. As well, high intracellular potassium concentrations are necessary for numerous cellular metabolic processes.

ADVERSE EFFECT(S):

CNS
Confusion

CVS
Bradycardia, cardiac depression, dysrhythmias, cardiac arrest, peaked T waves, prolonged PR interval, QRS complex widening

GI
N/V, abdominal cramping, diarrhea

Other
Hyperkalemia

PRECAUTION(S):
1. Local vein irritation may occur during infusion.
2. Cardiovascular disease.
3. Diabetes.
4. Metabolic acidosis.

CONTRAINDICATION(S):
1. Renal disease (90 percent is excreted by the kidneys and may result in hyperkalemia and cardiac arrest).
2. Tartrazine or ASA allergy.
3. Hyperkalemia.

potassium chloride (KCl) **Slow-K; K-Dur**

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
20-40 mEq/L in dextrose or NS solution, do not exceed 20 mEq/hour

PEDIATRIC DOSAGE:
3 mEq/Kg/24 hours at a rate ≤ 0.02 mEq/Kg/minute

SUPPLIED FORM(S):
Ampule: 20 mEq/10 mL (2 mEq/mL)
40 mEq/20 mL (2 mEq/mL)

ADDITIONAL INFORMATION:
1. Patients receiving IV potassium should have constant ECG monitoring.
2. Suspect hyperkalemia in patients with diabetic ketoacidosis, severe vomiting and diarrhea, uremia and renal patients (dialysis).
3. Hypokalemia may show flat or inverted T-waves, presence of a U-wave and ST segment depression.
4. KCl use should be tailored by lab analysis.

prednisolone **Prelone**

CLASSIFICATION(S):
Corticosteroid

INDICATION(S):
1. Severe allergic reactions/anaphylaxis.
2. Acute exacerbation of asthma/COPD.

THERAPEUTIC ACTION(S):
1. Corticosteroids diffuse across cell membranes and complex with specific cytoplasmic receptors. These complexes then enter the cell nucleus, bind to DNA, and stimulate transcription of messenger RNA (mRNA) and subsequent protein synthesis of various enzymes, thought to be ultimately responsible for two categories of effects of systemic corticosteroids (anti-inflammatory and immunosuppressant).
2. Decreases or prevents tissue responses to inflammatory processes, thereby reducing development of symptoms of inflammation without affecting the underlying cause.
3. Inhibits accumulation of inflammatory cells, including macrophages and leukocytes, lysosomal enzyme release, and synthesis and/or release of several chemical mediators of inflammation.

ADVERSE EFFECT(S):

CNS
Increased ICP, convulsions, vertigo, headache

CVS
Hypertension, CHF secondary to fluid retention, dysrhythmias

GI
Peptic ulcer, pancreatitis, abdominal distension, ulcerative esophagitis

Other
Increased intraocular pressure

PRECAUTION(S):
1. Infections.
2. Ulcerative colitis, inflammatory bowel disease.
3. Diverticulitis.
4. Active or latent peptic ulcer.
5. Hepatic/renal insufficiency.
6. Hypertension.

7. Osteoporosis.
8. Myasthenia gravis.
9. Convulsive disorders.
10. Recent AMI, CHF.

CONTRAINDICATION(S):
Patients already taking prednisolone.

ROUTE(S) OF ADMINISTRATION:
PO

ADULT DOSAGE:
50 mg PO

PEDIATRIC DOSAGE:
> 10 years - **50 mg** PO

SUPPLIED FORM(S):
Tablets: 50 mg

ADDITIONAL INFORMATION:
1. Current therapy with inhaled steroids is not a contraindication to the use of prednisolone.
2. Peak onset 1-2 hours.

CLASSIFICATION(S):
Antidysrhythmic

INDICATION(S):
1. Suppression of symptomatic PVCs.
2. Stable VT.
3. Wide complex tachycardia of unknown origin.
4. Persistent VF/Pulseless VT.
5. Recurrent VF/Pulseless VT.
6. Atrial fibrillation with rapid rate in WPW.
7. PSVT not controlled by adenosine.

THERAPEUTIC ACTION(S):
1. Class 1A antiarrhythmic.
2. Suppresses PVCs by decreasing automaticity.
3. Suppresses re-entry arrhythmias by prolonging the refractory period.
4. Increases threshold of VF.
5. Negative chronotropic, dromotropic and inotropic effects.
6. Potent peripheral vasodilation (vagolytic effects.)

ADVERSE EFFECT(S):

CNS
Seizures, confusion, dizziness

CVS
Hypotension, bradycardia, ECG abnormalities – widened QRS, prolonged PR or QT intervals, conduction disturbances (heart blocks) due to negative dromotropic effects.

GI
N/V

PRECAUTION(S):
1. AMI, CHF.
2. Cardiac, hepatic or renal insufficiency.
3. If cardiac or renal dysfunction is present, reduce maximum total dose to 12 mg/kg and maintenance infusion to 1-2 mg/minute.
4. Use caution with other drugs that prolong the QT interval (i.e., amiodarone).
5. May produce hypotension in states of impaired LV function.

CONTRAINDICATION(S):

1. Third degree heart block.
2. Hypotension.
3. Digitalis toxicity.
4. Tricyclic induced arrhythmias.
5. Torsade de pointes.
6. Pre-existing QT prolongation.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
Stable VT
20-30 mg/minute infusion

VF/Pulseless VT
30-50 mg/minute infusion

Run infusion until:

1. Dysrhythmia suppressed.
2. Hypotension develops.
3. QRS widens by 50 percent of original width.
4. Total of 17 mg/kg administered.

If arrhythmia is suppressed, begin drip at 1-4 mg/min.

PEDIATRIC DOSAGE:
15 mg/kg IV/IO infusion over 30-60 minutes

SUPPLIED FORM(S):
Vial: 1 g/10 mL (100 mg/mL)

ADDITIONAL INFORMATION:

1. Sequential use of two or more antiarrhythmic drugs compounds the adverse effects.
2. Proarrhythmic, especially in setting of AMI, hypokalemia, or hypomagnesemia.

prochlorperazine **Stemetil**

CLASSIFICATION(S):
Antiemetic; Antipsychotic

INDICATION(S):
1. Treatment of nausea and vomiting.
2. Treatment of mild psychotic disorders.

THERAPEUTIC ACTION(S):
1. Improves psychotic conditions by blocking postsynaptic dopamine D_2 receptors in the mesolimbic area of the brain, and by producing an alpha-adrenergic blockade.
2. Acts centrally to inhibit or block the dopamine D_2 receptors in the medullary chemoreceptor trigger zone (CTZ) and peripherally, by blocking the vagus nerve in the gastrointestinal tract. The antiemetic effects may be augmented by the anticholinergic, sedative, and antihistaminic effects of prochlorperazine.

ADVERSE EFFECT(S):

CNS
Extrapyramidal reactions, drowsiness, headache, seizures, depression

CVS
Tachycardia, hypotension

GI
Constipation, N/V, Dry mouth

PRECAUTION(S):
1. Patients with convulsive disorders may experience an increase in the incidence of seizures when placed on antipsychotic medications.
2. Phenothiazines may potentiate other CNS depressants.
3. Glaucoma.
4. Anticholinergic drugs are potentiated by prochlorperazine.
5. Increased incidence of adverse effects is greater in patients, 55 years or older.
6. Patients taking QT prolonging medications.

CONTRAINDICATION(S):
1. Circulatory collapse.
2. Altered level of consciousness induced by CNS depressants (alcohol, hypnotics, narcotics).
3. Parkinson's disease.

4. Cardiovascular disorders/arrhythmias.
5. Congenital long QT syndrome.
6. Liver and renal insufficiency.
7. Hypersensitivity.
8. Phenothiazine allergy.

ROUTE(S) OF ADMINISTRATION:
IM; IV

ADULT DOSAGE:

Nausea & Vomiting
IV: **2.5-10 mg** q 3-4 hours prn, max 10 mg/dose
IM: **5-10 mg** q 3-4 hours prn

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Ampule: 10 mg/2 mL (5 mg/mL)

ADDITIONAL INFORMATION:
1. Orthostatic hypotension is common, therefore, have patient rise slowly from the reclining position.
2. May be used to treat acute psychotic behaviour at a dose of 10-20 mg IM q 2-4 hrs (*not* the drug of choice).

propranolol **Inderal**

CLASSIFICATION(S):
Beta– drenergic Receptor Blocking Agent

INDICATION(S):
1. To reduce $Beta_1$ effects in acute myocardial infarction (decreases myocardial workload and oxygen demand).
2. Rate control in SVT, PSVT, A-Fib, and A-Flutter.
3. Unstable angina.
4. Emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

THERAPEUTIC ACTION(S):
1. $Beta_1$ receptor blockade resulting in negative chronotropic, inotropic, and dromotropic response. The end result is a decrease in myocardial oxygen consumption and workload.
2. Blocks the agonistic effects of the sympathetic neurotransmitters by competing for receptor binding sites.
3. Inhibits $beta_2$ receptors at higher doses.

ADVERSE EFFECT(S):

CNS
Fatigue, dizziness, headache, lightheadedness

RESP
Bronchospasm, dyspnea

CVS
Bradycardia, second and third degree blocks, hypotension, CHF

GI
N/V

PRECAUTION(S):
1. Beta blocker use in diabetic and shock patients may mask catecholamine-induced signs and symptoms of acute hypoglycemia and hypovolemia.
2. May impair recovery from hypoglycemia in diabetics because they block the effects of catecholamines that promote glycogenolysis and mobilize glucose in response to hypoglycemia.
3. Liver and renal insufficiency.

4. Administration of epinephrine for allergic and anaphylactic reactions to patients taking beta blockers may result in a hypertensive crisis. In these cases, the beta effects of epinephrine are blocked allowing the vasoconstrictive alpha properties to take effect.
5. Geriatric patients may be extremely sensitive to a drop in HR and BP.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Sinus bradycardia, sick sinus syndrome, second and third degree heart blocks.
3. Right ventricular failure secondary to pulmonary hypertension.
4. Cardiogenic shock.
5. CHF.
6. Bronchospastic disease (asthma, COPD, emphysema, chronic bronchitis).
7. MI patients:
    - HR < 60 beats/minute
    - Heart blocks > first degree
    - Systolic BP < 100 mmHg
8. Concomitant use of calcium channel blockers (wait several hours), including patients on oral calcium channel blockers (may cause severe hypotension).
9. Drug-induced tachycardia (especially cocaine).
10. Drug-induced hypertension.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

0.1 mg/kg slow IV push, divide into 3 equal doses at 2-3 minute intervals. Do not exceed 1 mg/minute, repeat after 2 minutes if required

PEDIATRIC DOSAGE:

0.01 mg/kg slow IV push

SUPPLIED FORM(S):

1 or 10 mL vials (1 mg/mL)

ADDITIONAL INFORMATION:

1. Monitor vital signs, ECG and clinical response frequently.
2. Avoid HR < 60 beats/minute, BP < 100 mmHg.
3. Best results seen if the drug is given within two hours of the onset of signs and symptoms of AMI.

4. Concurrent administration with amiodarone may result in additive depressant effects on conduction and negative inotropic effect.s
5. In drug-induced hypertension beta blockers may only block beta receptors, leaving unopposed alpha-adrenergic stimulation and worsening hypertension. Hypertension is often short-lived so aggressive therapy for drug-induced hypertensive emergencies is rarely needed and may contribute to worsening hypotension after the hypertension resolves. Benzodiazepines are the first drug of choice for the treatment of sympathomimetic OD (i.e. cocaine).
6. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.

propofol **Diprivan**

CLASSIFICATION(S):
General Anaesthetic

INDICATION(S):
1. Propofol is a short-acting IV anaesthetic agent that can be used for sedation or the induction and maintenance of general anesthesia.

THERAPEUTIC ACTION(S):
1. Short acting hypnotic/sedative.
2. Potent respiratory depressant.
3. No analgesic activity.

ADVERSE EFFECT(S):

CNS
Dizziness, headache, sedation

RESP
Apnea, dyspnea, hypoxia

CVS
Hypotension, CHF

GI
N/V, abdominal cramps

Endocrine
Increased plasma glucose, hyperlipemia

Other
Twitching, jerking extremities, local pain at injection site, fever

PRECAUTION(S):
1. Elderly or debilitated patients.
2. Cardiovascular/cerebrovascular disease.
3. Hypovolemia.
4. Primary hyperlipoproteinemia.
5. Diabetic hyperlipidemia.
6. Pancreatitis.

7. Epilepsy.
8. Pulmonary edema.
9. Increased ICP.
10. Dysrhythmias.

CONTRAINDICATION(S):

1. Hypersensitivity to propofol, soybean oil, egg lecithin and glycerol.
2. Use of propofol in patients with hemodynamic compromise, poor ventricular function, or high pulmonary artery pressures may be accompanied by acute decompensation, which is resistant to standard resuscitation measures
3. Pediatrics, under three years of age.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Sedation during Surgical or Diagnostic Procedures

Initiation:

- Slow injection method: **0.25 - 1 mg/kg*** over 3-5 minutes
- Infusion method: **0.025 to 0.1 mg/kg/min*** (1.5-6 mg/kg/hr) titrated to desired level of sedation

Maintenance:

- **0.025-0.1 mg/hg/min*** (1.5-6 mg/kg/hr) during the initial 10-15 minutes of sedation maintenance
- Bolus administration of **10 to 15 mg*** may be necessary if a rapid increase in sedation depth is required

***Note:** for elderly, debilitated, hypovolemic and ASA III or IV patients, reduce sedation dose by 70-80 percent of the adult dose. Rapid bolus dose administration should not be used for sedation in these patients.

Mechanically ventilated patients requiring short-term sedation or frequent neurologic assessment (i.e. closed head injury or stroke syndromes):

- Slow continuous infusion of **5-10 µg/kg/minute**
- Titrate to desired clinical effect and minimum hypotension with increments of 5-10 µg/kg/min until desired level of sedation is achieved.
- A minimum period of five minutes between adjustments should be allowed for onset of peak drug effect.

- Most patients require maintenance rates of 5-50 µg/kg/min. Reduce dose in patients who have received large doses of narcotics.
- Bolus (slow) administration of 10-20 mg should only be used to rapidly increase sedation depth in patients where hypotension is not likely to occur.

Anaesthesia

Adult (non-elderly or debilitated):

- Induction: **1-2.5 mg/kg** (approx. 40 mg every ten seconds until induction onset).
- Maintenance: titrated to desired effect, generally **100-200 µg/kg/minute.**
- Intermittent Bolus: increments of **25-50** mg prn.

Elderly and debilitated and/or ASA III or IV Patients:

- Induction: **1-1.5 mg/kg** (approx. 20 mg every ten seconds until induction onset) dose should be carefully titrated to effect.
- Maintenance Infusion: **50-100 µg/kg/minute** (3-6 mg/kg/hr.)

PEDIATRIC DOSAGE:

Patients under three years of age: Follow same dosage and guidelines as for adult administration.

SUPPLIED FORM(S):

Vials: 10 mg/ml, 20 ml and 100 ml

ADDITIONAL INFORMATION:

1. Strict aseptic technique must always be used, as the propofol (lipid emulsion) supports rapid microbial growth.
2. Facilities for maintenance of patent airway, artificial ventilation, oxygen enrichment and circulatory resuscitation must be readily available.
3. When used for sedation for surgical or diagnostic procedures, patients must be continuously monitored by an individual not involved in the conduct of the surgical/diagnostic procedure.
4. There is a rapid return of spontaneous respirations once propofol is discontinued. This rapid reversal allows for early extubation post procedure.
5. Dilution for IV infusion procedures:
    - Do not mix with other agents prior to administration.
    - **Dilute with D_5W only**, to a minimum concentration of two mg/ml.
    - Do not use if there's evidence of separation of the phases of the emulsion.
    - Do not administer via a microbiological filter.
    - Propofol is more stable undiluted when in contact with glass than plastic.

- Do not administer through a three-way stop cock as plastic is degraded by propofol.
- Change tubing every 24 hours.
- Diluted solutions should be used within six hours of preparation.

6. American Society of Anesthesiologists (ASA) - Physical Status Classification System:
   - **ASA I** – Patients are considered to be normal and healthy. Patients are able to walk up one flight of stairs or two level city blocks, without distress.
   - **ASA II** – Patients have mild to moderate systemic disease or are healthy. Patients are able to walk up one flight of stairs or two level city blocks, but will have to stop after completion of the exercise because of distress. Examples: well-controlled non-insulin controlled diabetes, epilepsy, asthma, and/or thyroid conditions; ASA I with a respiratory condition, pregnancy, and/or active allergies.
   - **ASA III** – Patients have severe systemic disease that limits activity, but is not incapacitating. Patients are able to walk up one flight of stairs or two level city blocks, but will have to stop enroute because of distress. Examples: angina pectoris, MI or CVA history, insulin dependent diabetes, CHF, COPD.
   - **ASA IV** – Patients have severe systemic disease that limits activity and is a constant threat to life. Patients are unable to walk up one flight of stairs or two level city blocks. Distress is present even at rest. Examples: unstable angina, MI or CVA within the last six months, hypertension, severe CHF or COPD, uncontrolled epilepsy, diabetes, or thyroid condition.
   - **ASA V** – Patients are moribund and are not expected to survive more than 24 hours without an operation. These patients are almost always hospitalized, terminally ill patients.
   - **ASA VI** – Clinically dead patients being maintained for harvesting of organs.

CLASSIFICATION(S):
Sympathomimetic

INDICATION(S):
Laryngo/bronchospasm due to asthma, croup, bronchiolitis or bronchitis.

THERAPEUTIC ACTION(S):

Alpha $_1$ Effects
Peripheral vasoconstriction (increases perfusion pressure during CPR that improves coronary and cerebral perfusion).

Beta $_1$ Effects
1. Positive chronotropic.
2. Positive inotropic.
3. Positive dromotropic.
4. Increases automaticity.

Beta $_2$ Effects
1. Bronchodilation.
2. Peripheral vasodilation (minimal).

Bronchodilator Effect
Acts by stimulating beta$_2$ – adrenergic receptors in the lungs to relax bronchial smooth muscle, thereby relieving bronchospasm. This action is believed to result from increased production of cyclic adenosine 3,5-monophosphate and ensuing reduction in intracellular calcium concentration caused by activation of the enzyme adenylate cyclase that catalyzes the conversion of adenosine triphosphate (ATP) to cAMP. Increased cAMP concentrations, in addition to relaxing bronchial smooth muscle, inhibit release of mediators of immediate hypersensitivity from cells, especially from mast cells.

Allergy/Anaphylaxis Effects
Stimulates the release of cyclic adenosine monophosphate (cAMP). CAMP inhibits the release of mediators associated with allergic and anaphylactic reactions. These mediators are stored in granules within the cytoplasm of basophiles and mast cells. One of the involved mediators is histamine which is responsible for vasodilation and increased permeability of blood vessels.

Croup Effects
Epinephrine's alpha-adrenergic stimulating effects produces constriction of arteries and veins. The resulting decreased mucosal edema is thought to be the mechanism by which epinephrine and racepinephrine are beneficial in the treatment of croup.

Other
Metabolized by monoamine oxidase (MAO) and catechol-o-methyltransferase (COMT)

ADVERSE EFFECT(S):

CNS
Nervousness, headache

CVS
Tachycardia, palpitations, hypertension, increased oxygen demand leading to arrhythmias

GI
N/V

PRECAUTION(S):
1. Cardiovascular disease.
2. Elderly patients.
3. Hypertension.
4. Glaucoma.

CONTRAINDICATION(S):
1. Uncorrected tachydysrhythmias.
2. MAO inhibitor use within 14 days.

ROUTE(S) OF ADMINISTRATION:
Nebulized

ADULT DOSAGE:
0.25-2.5 mL of a 2.25% solution nebulized, repeat x 1 in 5 minutes prn

PEDIATRIC DOSAGE:
Same as adult.

SUPPLIED FORM(S):
Various preparations:

ADDITIONAL INFORMATION:
If racemic epinephrine is unavailable nebulize 5 mg (5 mL) epinephrine 1:1000.

ranitidine **Zantac**

CLASSIFICATION(S):
Histamine H_2 Receptor Antagonist

INDICATION(S):
1. Treatment of duodenal and gastric ulcers.
2. Gastroesophageal reflux disease.
3. Upper gastrointestinal hemorrhage where inhibition of gastric acid secretion is beneficial.

THERAPEUTIC ACTION(S):
1. Competitively inhibits basal and nocturnal gastric acid secretion by competitive inhibition of the action of histamine at the histamine H_2 receptors of gastric parietal cells. They also inhibit gastric acid secretion stimulated by food, caffeine, insulin, and physiological vagal reflex.
2. Increases the production of gastric mucus.

ADVERSE EFFECT(S):

CNS
Headache, malaise, dizziness, vertigo, anxiety

CVS
Tachycardia, PVCs, AV block, bradycardia

GI
Diarrhea, constipation, N/V, abdominal discomfort

PRECAUTION(S):
1. Increased cardiovascular complications accompanied by rapid administration.
2. Renal and hepatic insufficiency.
3. Use cautiously in elderly (especially patients taking hypoglycemic drugs and theophylline preparations).

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
PO; IV

ADULT DOSAGE:
50 mg slow IV push q 6-8 hrs, max 400 mg/day
Place **50 mg** in 100 mL NS or D_5W and infuse over 15 minutes

PEDIATRIC DOSAGE:
Not applicable.

SUPPLIED FORM(S):
Ampules: 25 mg/mL, 2 or 40 mL

ADDITIONAL INFORMATION:
Smoking is associated with a higher rate of ulcer relapse; therefore, patients should be advised to stop smoking. If they fail to comply, their dosage frequency should be increased.

reteplase (Retavase)

CLASSIFICATION(S):
Fibrinolytic/thrombolytic Agent

INDICATION(S):
1. AMI (to reduce CHF, improve ventricular function, and reduce mortality):
- ST elevation (≥ 1 mm in ≥ 2 contiguous leads) or new or presumably new LBBB; strongly suspicious for injury (BBB obscuring ST analysis).
- Time form onset of symptoms, less than 12 hours.

THERAPEUTIC ACTION(S):
1. When a clot is formed, an inactive plasma enzyme called plasminogen is incorporated into the clot. Body tissues, blood and introduced agents (reteplase) contain substances that can activate plasminogen to plasmin, an active enzyme. Once plasmin is formed, it can dissolve the clot by digesting fibrin threads and inactivating substances such as fibrinogen, prothombin, and factors V, VIII, and XII.
2. Reteplase acts by directly catalyzing the cleavage of plasminogen to form plasmin. Plasmin then degrades the fibrin matrix of the thrombus, causing thrombolysis.
3. Though related to alteplase, its longer *half-life* allows it to be administered by bolus injection. Reteplase has less affinity for surface fibrin on a clot, which may allow increased clot penetration and explain its increased potency over alteplase.
4. Clot dissolution and reperfusion occur with a higher frequency when therapy is initiated earlier since most clots become more resistant to lysis with age.

ADVERSE EFFECT(S):

CVS
Chest pain or various reperfusion dysrhythmias

HEMAT
Internal bleeding (GI, GU, RESP tract, retroperitoneal, intracranial); superficial or surface bleeding (primarily at puncture sites)

GI
N/V, fever

PRECAUTION(S):
1. Recent major surgery within ten days.
2. Hx or evidence of transient ischaemic attack (TIA).
3. Recent GI/GU bleeding within ten days.
4. Recent trauma within ten days (including CPR).

5. Hx or evidence of uncontrolled hypertension.
6. 75 years of age.
7. Left heart thrombus (mitral stenosis with A-Fib).
8. Hemostatic defects including those secondary to severe hepatic or renal disease.
9. Liver dysfunction.
10. Post-partum state.
11. Diabetic hemorrhagic retinopathy.
12. Other hemorrhagic ophthalmic conditions.
13. Septic thrombophlebitis.
14. Patients currently receiving oral anticoagulants.
15. Known bleeding disorders.
16. Terminal illness.
17. Infective endocarditis.
18. Any other condition in which bleeding presents a significant hazard or difficulty to manage due to location.

In all of the above, the benefit must clearly out weigh the risk for thrombolytic use.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Active internal bleeding.
3. Hx of CVA (within two months).
4. Suspected subarachnoid hemorrhage.
5. Patients currently receiving other IV thrombolytics.
6. Recent intracranial, intraspinal surgery or trauma, including traumatic CPR (within two months).
7. Intracranial neoplasm, AV malformation or aneurysm.
8. Severe uncontrolled hypertension (i.e. diastolic > 110 mmHg &/or systolic > 180 mmHg).
9. Aortic dissection.
10. Acute pericarditis.

ROUTE(S) OF ADMINISTRATION:

IV infusion

ADULT DOSAGE:

10 units IV bolus over 2 minutes repeated X 1 in 30 minutes (flush IV line with NS before and after each bolus)

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Kit contains: Two 10.8 unit vials.
Two vials of sterile water for dilution.

ADDITIONAL INFORMATION:

1. Generally, reperfusion arrhythmias are only treated if the patient is symptomatic.
2. Patient care responsibilities during reteplase infusion:
    - Start two peripheral IVs in opposite limbs with NS TKVO.
    - Monitor vital signs and neurologic function q 15 minutes x 1 hour, then q 30 minutes for the duration of the infusion.
    - Check IV/venipuncture sites q 30 min x 3 hours.
    - Continuous cardiac monitoring is required (including serial 12 lead ECGs).
    - Inspect all secretions for hemorrhage.
    - Avoid taking BP in the arm with the IV sites or venipuncture (whenever possible).
    - Avoid arterial and venous puncture for 36 hours.
3. Reconstitute with sterile water for injection without preservatives. Do not use bacteriostatic water.
4. Slight foaming may occur with reconstitution (avoid excessive agitation).
5. Do not administer through the same IV as dobutamine, dopamine, heparin or nitroglycerine.

CLASSIFICATION(S):
Nondepolarizing Neuromuscular Blocking Agent

INDICATION(S):
1. To provide skeletal muscle relaxation and paralysis to facilitate endotracheal intubation.
2. Situations include an unprotected airway or respiratory failure in the following conditions:
    - Head injury.
    - Drug overdose.
    - Status epilepticus.
    - Agitated or combative patients.
    - Trismus.
    - Multiple trauma.
    - Severe respiratory distress.

THERAPEUTIC ACTION(S):
1. Competes against acetylcholine for cholinergic receptors at the motor end-plate. Once bound to receptors, no response is produced resulting in the absence of muscle fasciculation before flaccid paralysis.
2. Onset of action is 60-90 seconds with a dose-dependent-duration of action between 10-30 minutes (mean 20 minutes).
3. Rocuronium has no effect on consciousness, pain threshold, and cognitive activity of the brain.

ADVERSE EFFECT(S):

RESP
Bronchospasm, rhonchi

CVS
Hypotension, hypertension, tachycardia, dysrhythmias

GI
N/V

Note: < 1% incidence of adverse effects

PRECAUTION(S):

1. Cardiovascular, hepatic or renal insufficiency.
2. Neuromuscular disease (myasthenia gravis).
3. Does not stop neuronal seizure activity (which may be undetectable in a paralyzed patient).
4. Geriatric patients (>65 yrs) show a longer onset time and duration of blockade than adults at equivalent doses.
5. Possibility for a difficult intubation (i.e. obesity).

CONTRAINDICATION(S):

1. Rocuronium or bromide allergy.
2. Any situation where you do not have adequate airway control (inability to ventilate with a BVM).
3. Upper airway obstruction (partial or complete).

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Standard Dose

0.6-1.2 mg/kg

Maintenance Dose

0.1-0.2 mg/kg will provide additional blockade approximately as long as the initial dose. Administered, based on recovery of muscle function.

PEDIATRIC DOSAGE:

Standard Dose

0.6-1.2 mg/kg; neuromuscular blockade may be prolonged in younger children.

Maintenance Dose

0.1-0.2 mg/kg will provide additional blockade approximately as long as the initial dose. Administered, based on recovery of muscle function.

SUPPLIED FORM(S):

Vial: 50 mg/5 mL

ADDITIONAL INFORMATION:

1. Chronic use of antiepileptic agents such as carbamazepine (Tegretol) or phenytoin (Dilantin) may shorten the length of neuromuscular blockade.
2. Rocuronium should not be administered before sedation is induced.
3. May be reversed by neostigmine as this agent possesses anticholinesterase activity allowing levels of acetylcholine to rise at the postsynaptic receptor.
4. Reversal of a nondepolarizing neuromuscular blocking agent should not be attempted until some movement is noted or a peripheral nerve stimulator is used to demonstrate return of function.
5. Return of muscular movement is usually noted approximately 20-45 minutes after initial flaccid paralysis.
6. Must be refrigerated - if left un-refrigerated, replace after 60 days.

CLASSIFICATION(S):
Bronchodilator (sympathomimetic)

INDICATION(S):
Treatment of bronchospasm from (asthma, chronic bronchitis, COPD, anaphylaxis or emphysema).

THERAPEUTIC ACTION(S):

1. Salbutamol acts by stimulating $beta_2$ receptors in the lungs to relax bronchial smooth muscle, thereby relieving bronchospasm. This action is believed to result from increased production of cyclic adenosine 3,5-monophosphate (cyclic 3,5-AMP; cAMP) and ensuing reduction in intracellular calcium concentration caused by activation of the enzyme adenylate cyclase that catalyzes the conversion of ATP to cAMP. Increased cAMP concentrations, in addition to relaxing bronchial smooth muscle, inhibit release of mediators of immediate hypersensitivity from cells, especially from mast cells. Onset of action is 5-15 minutes.
2. Mild $Beta_1$ effects.
3. Mild peripheral vasodilation.
4. $Beta_2$ selectively lost with high doses ($Beta_1$ and $Beta_2$ effects seen).

ADVERSE EFFECT(S):
CNS
Nervousness, tremors, dizziness, headache

RESP
Severe paradoxical bronchospasm from repeated use (rare)

CVS
Tachycardia, palpitations

PRECAUTION(S):

1. Cardiovascular disease.
2. Dysrhythmias.
3. Hypertension.

CONTRAINDICATION(S):
Uncontrolled tachydysrhythmias.

ROUTE(S) OF ADMINISTRATION:
Nebulized (use nonhumidified O_2 at 6-8 L/minute); ETT

ADULT DOSAGE:
5 mg in 2.5-5 mL NS repeat prn

PEDIATRIC DOSAGE:
< 10 kg - **1.25 mg**
10-20 kg - **2.5 mg**
> 20 kg - **5 mg**

Mix all dosages in 2.5 mL NS

SUPPLIED FORM(S):
Bottle: 50 mg/10 mL (5 mg/mL)
Nebule: 2.5 mg/2.5 mL

ADDITIONAL INFORMATION:
1. Beta blocking agents will antagonize the effects of salbutamol.
2. May be used as adjunctive therapy in treating hyperkalemia.
3. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication assists in the antagonism of the toxic effects of hyperkalemia at the cell membrane, redistribution/intracellular shift of K^+ into cells, and *elimination* of excess K^+. The dosages are as follows:
    - Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose.
    - Sodium Bicarbonate – 1 mEq/kg q 15 min.
    - Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV.
    - Nebulized ventolin – 10-20 mg over 15 min prn.
    - Lasix – 40-80 mg slow IV push.
4. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    - 5.5 to < 6 – peaking (tenting) of T waves.
    - 6 to < 6.5 – increasing PR and QT intervals.
    - 6.5 to < 7 – flattened P waves and ST segments.
    - 7 to < 7.5 – widened QRS complexes.
    - 7.5 to < 8 – deepening S waves, merging of S and T waves.
    - 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance.
    - 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole.

sodium bicarbonate

CLASSIFICATION(S):
Alkalinizing agent (buffer)

INDICATION(S):
1. Metabolic acidosis in cardiac arrest (i.e. diabetic ketoacidosis, renal dialysis patients).
2. Hyperkalemia.
3. Tricyclic antidepressant overdose.

THERAPEUTIC ACTION(S):
1. Increases plasma bicarbonate.
2. Raises blood pH (shifts K^+ intracellularly).
3. Buffers excess hydrogen ion concentration.
4. The exact mechanism of action for TCA overdose is unknown. Tricyclic overdoses have a sodium channel blocking effect and the administration of Na HCO_3 overcomes this sodium blockade. Secondly but not as significant, Na HCO_3 increases the pH which results in increased protein binding of the drug. The end result is a decrease in the toxic effects produced by the tricyclic.

ADVERSE EFFECT(S):

RESP
Increased CO_2 production

CVS
CHF, edema

Fluid & Electrolyte:
1. Metabolic acidosis.
2. Water retention.
3. Na HCO_3 administration transiently raises CO_2 levels (intracellularly) which produces paradoxical acidosis.
4. Na HCO_3 decreases K^+ levels making myocardium prone to arrhythmias.
5. If bloods turns alkaline, it shifts the oxyhemoglobin dissociation curve to the left and prevents the release of O_2 to tissues causing hypoxia.

PRECAUTION(S):
1. Extravasation causes tissue necrosis.
2. If given simultaneously, may inactivate catecholamines and calcium.
3. Impaired renal function.
4. Sodium retaining states.

sodium bicarbonate

CONTRAINDICATION(S):

1. In cardiac arrest, sodium bicarbonate therapy should be considered only after the standard interventions (such as defibrillation, cardiac compression, intubation, hyperventilation, and more than one trial of epinephrine) have been used.
2. Suspected respiratory/metabolic alkalosis.
3. None in TCA overdose.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Cardiac Arrest

1 mEq/kg given as an initial dose then 0.5 mEq/kg q 10 minutes prn

Ideally sodium bicarbonate therapy should be guided by blood gas analysis.

Symptomatic TCA Overdose

1-2 mEq/kg slow IV push, repeat q 1-2 minutes until QRS shortens to < 100ms, arrhythmias suppressed, and blood pressure returns to a normal range

Bolus therapy may be followed by an infusion of **150 mEq/kg** plus **KCL 30 mEq** mixed in 850 ml of NS at an initial rate of 150-200 ml/hr, titrated to keep a pH of 7.5-7.55.

PEDIATRIC DOSAGE:

Same as adult.

SUPPLIED FORM(S):

Preload: 50 mEq/50 mL (1 mEq/mL)

ADDITIONAL INFORMATION:

1. Adequate alveolar ventilation is the mainstay for control of acid-base balance in cardiac arrest. Hyperventilation corrects respiratory acidosis by removing carbon dioxide.
2. TCA toxic levels:
    - 10 mg/kg unlikely to result in severe toxicity.
    - 35 mg/kg are likely to produce life threatening results.
3. The current regime for treatment of moderate to severe hyperkalemia includes the combination of calcium chloride, sodium bicarbonate, insulin, glucose, nebulized ventolin and lasix. This combination of medication assists in the antagonism of the toxic effects of hyperkalemia at the cell membrane, redistribution/intracellular shift of K^+ into cells, and *elimination* of excess K^+. The dosages are as follows:

- Calcium chloride – 8-16 mg/kg slow IV at < 100 mg/minute, max 1gram/dose.
- Sodium Bicarbonate – 1 mEq/kg q 15 min.
- Insulin plus glucose – 10 units regular insulin IV plus 25g $D_{50}W$ IV.
- Nebulized ventolin – 10-20 mg over 15 min prn.
- Lasix – 40-80 mg, slow IV push.

4. The evolution of hyperkalemia may be evidenced by the following ECG changes as related to serum potassium levels:
    - 5.5 to < 6 – peaking (tenting) of T waves.
    - 6 to < 6.5 – increasing PR and QT intervals.
    - 6.5 to < 7 – flattened P waves and ST segments.
    - 7 to < 7.5 – widened QRS complexes.
    - 7.5 to < 8 – deepening S waves, merging of S and T waves.
    - 8 to < 10 – sine-wave shaped complexes begin; idioventricular complexes and rhythms; VT-like appearance.
    - 10 – PEA (often with a "sine wave" appearance), VF/VT, asystole.

sodium nitroprusside **Nipride**

CLASSIFICATION(S):
Antihypertensive

INDICATION(S):
1. Acute hypertensive crisis.
2. To reduce afterload in heart failure and acute pulmonary edema.

THERAPEUTIC ACTION(S):
1. Potent peripheral vasodilator effecting both arterial and venous smooth muscle.
2. Reduces BP by decreasing peripheral arterial resistance (afterload) and increasing venous capacity (preload).
3. Effects are immediate and cease within minutes after infusion is discontinued.

ADVERSE EFFECT(S):
Most adverse effects occur due to a rapid infusion rate and are reversible with slowing of the infusion or with discontinuation.

CNS
Restlessness, agitation, headache dizziness

CVS
Hypotension, palpitations, chest pain

GI
N/V, abdominal cramping

Other
Muscle twitching, diaphoresis, CO_2 retention

PRECAUTION(S):
1. Monitor vital signs frequently.
2. Decrease dosage in the elderly as they tend to become more sensitive to the hypotensive effects.
3. Infusion pump is mandatory.
4. Once dissolved in solution, the container should be wrapped in aluminum foil as it deteriorates in the presence of light.
5. Solutions should be used within 12 hours.

CONTRAINDICATION(S):

1. Compensatory hypertension.
2. Uncorrected hypovolemia.
3. Known inadequate cerebral circulation.

ROUTE(S) OF ADMINISTRATION:
IV infusion

ADULT DOSAGE:
0.1 µg/kg/minute, increase infusion by 0.1 µg/kg/minute q 3-5 minutes, titrate to desired effect, max 5 µg/kg/minute

Reconstitute 50-100 mg dry powder in 2-3 mL D_5W or NS and add to 250 mL D_5W Or NS

50 mg/250 mL NS = 200 ug/mL
100 mg/250 mL NS = 400 ug/mL

Note: Once reconstituted, the solution may have a faint brownish tint without any change in the drug's potency. Highly coloured solutions of blue, green, or dark red should be discontinued and replaced with a freshly prepared solution.

PEDIATRIC DOSAGE:
Not applicable.

SUPPLIED FORM(S):
500 mg/vial in powdered form

ADDITIONAL INFORMATION:
Keep the solution running no longer than 12 hours between solution changes.

CLASSIFICATION(S):
Fibrinolytic/Thrombolytic Agent

INDICATION(S):
1. Treatment of acute transmural MI to reduce infarct size, reduce CHF, improve ventricular function and reduce mortality.
    - ST elevation of one mm or more in two or more contiguous leads.
    - New or presumably new left bundle branch block.
2. Treatment of diagnostically confirmed acute, massive pulmonary embolism.

THERAPEUTIC ACTION(S):
1. When a clot is formed an inactive plasma enzyme called plasminogen is incorporated into the clot. Streptase, a bacterial protein synthesized by Group C beta-hemolytic streptococci, activates plasminogen to form plasmin. When plasmin is generated close to a fibrin clot, it will digest the fibrin threads and dissolve the clot.
2. Clot dissolution and reperfusion occur with a higher frequency when therapy is initiated earlier since clots become more resistant to lysis with age.

ADVERSE EFFECT(S):

RESP
Bronchospasm

CVS
Hypotension, reperfusion dysrhythmias

Skin
Urticaria, itching, flushing

Other
Fever, Internal bleeding (GI, GU, retroperitoneal, intracranial), superficial surface bleeding (primarily at the puncture site)

PRECAUTION(S):
1. Recent major surgery within ten days.
2. Hx or evidence of TIA.
3. Recent GI, GU bleeding within ten days.
4. Recent trauma within ten days (including traumatic CPR).
5. Hx or evidence of uncontrolled hypertension.

6. Seventy five years of age or older.
7. High likelihood of left heart thrombus (mitral stenosis with AF).
8. Hemostatic defects including those secondary to severe hepatic or renal disease.
9. Liver dysfunction.
10. Pregnancy or post-partum state.
11. Diabetic hemorrhagic retinopathy.
12. Other hemorrhagic ophthalmic conditions.
13. Septic thrombophlebitis.
14. Patients currently receiving oral anticoagulants.
15. Known bleeding disorders.
16. Terminal illness.
17. Infective endocarditis.
18. Any other condition in which bleeding presents a significant hazard or difficulty to manage due to its location.
19. Prior administration of streptokinase due to antibody and neutralizing antibody formation.

In all the above, the benefit must clearly outweigh the risk of thrombolytic use.

CONTRAINDICATION(S):

1. Hypersensitivity.
2. Active internal bleeding.
3. Hx of CVA (within two months)
4. Patients currently receiving other IV thrombolytics.
5. Recent intracranial/intraspinal surgery or trauma (within two months).
6. Intracranial neoplasm, AV malformation or aneurysm.
7. Severe uncontrolled hypertension (diastolic > 110 mmHg &/or systolic > 180 mmHg).
8. Aortic dissection.
9. Acute pericarditis.

ROUTE(S) OF ADMINISTRATION:
IV infusion

ADULT DOSAGE:
AMI
1,500, 000 IU placed in 50-100 mL NS, run over 60 minutes

Acute PE
Loading dose – **250,000 IU** IV infused over 30 minutes

Maintenance dose – **100,000 IU** IV for 24 hours

PEDIATRIC DOSAGE:
Not applicable.

SUPPLIED FORM(S):
Vial: 250,000 IU/6.5 mL (green labels)
750,000 IU/6.5 mL (blue labels)
1,500,000 IU/6.5 mL (red labels)
Infusion bottle: 1,500,000 IU/68 mL

ADDITIONAL INFORMATION:

- Generally, reperfusion arrhythmias are only treated if the patient is symptomatic.
- Patient care responsibilities during streptokinase infusion:
    - Start two peripheral IVs in opposite limbs with NS TKVO.
    - Monitor vital signs and neurologic function q 15 minutes x 1 hour, then q 30 minutes for the duration of the infusion.
    - Check IV/venipuncture site q 30 minutes for subcutaneous bleeding or bruising.
    - Continuous cardiac monitoring is required (including serial 12 lead ECGs).
    - Inspect all secretions for hemorrhage.
    - Avoid taking BP in the arm with the IV sites or venipuncture (whenever possible).
    - Avoid arterial and venous puncture for 36 hours.
    - Observe for sign and symptoms of allergic/anaphylactic reactions.

3. Reconstitute with sterile water for injection without preservatives. Do not use bacteriostatic water.
4. Slight foaming may occur with reconstitution (avoid excessive agitation).
5. Do not administer through the same IV as dobutamine, dopamine, heparin or nitroglycerine.
6. Infusion pump is mandatory.

succinylcholine (SCH) Anectine

CLASSIFICATION(S):
Depolarizing Neuromuscular Blocking Agent

INDICATION(S):
1. To provide skeletal muscle relaxation and paralysis to facilitate endotracheal intubation.
2. Situations where use is warranted include an unprotected airway or respiratory failure in the following conditions:
    - Head injury.
    - Drug overdose.
    - Status epilepticus.
    - Agitated or combative patients.
    - Trismus.
    - Multiple trauma.
    - Severe respiratory distress.

THERAPEUTIC ACTION(S):
1. Combines with cholinergic receptors on the motor end-plate to produce depolarization which is evident by fasciculation. Immediately after fasciculation occurs, all neuromuscular transmission is inhibited as long as adequate amounts of succinylcholine remain at the receptor site.
2. Onset of flaccid paralysis is less than one minute and a single administration can last from 4-10 minutes.
3. Succinylcholine has no effect on consciousness, pain threshold and cognitive activity of the brain.

ADVERSE EFFECT(S):

CNS
Increased intracranial pressure

CVS
Bradycardia (prominent in children), dysrhythmias

GI
Increased intragastric pressure (potential for regurgitation/aspiration)

Fluid & Electrolyte
Hyperkalemia (causes a transient release/shift of potassium out of cells)

Other
Increased intraocular pressure, malignant hyperthermia, muscle fasciculation's

PRECAUTION(S):
1. Renal insufficiency.
2. Situation where histamine release may be hazardous (i.e., acute exacerbation of asthma).
3. May result in prolonged respiratory muscle paralysis or weakness if given over prolonged periods.
4. Trauma patients with fractures (as the initial muscle fasciculation may result in additional trauma).
5. Does not stop neuronal seizure activity (which may be undetectable in a paralyzed patient).
6. Possibility for a difficult intubation (i.e., obesity).

CONTRAINDICATION(S):
1. Penetrating globe injury.
2. Acute narrow angle glaucoma.
3. Neuromuscular disease.
4. Hx of malignant hyperthermia.
5. Hypersensitivity.
6. Spinal cord injury, crush injuries, major burns or multiple trauma more than 48 hours old may result in severe hyperkalemia.
7. Hyperkalemia.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
1-1.5 mg/kg, max 150 mg

PEDIATRIC DOSAGE:
1 mg/kg

SUPPLIED FORM(S):
Ampule: 100 mg/5 mL (20 mg/mL)
Multi-dose vials: 10 and 20 mL (20 mg/mL)

ADDITIONAL INFORMATION:

1. Must be stored in a refrigerator.
2. Young children less than ten10 kg may be less sensitive than adults and may require a slightly higher dose (1.5-2 mg/kg).
3. Succinylcholine should not be administered before sedation is induced.
4. The multiple-dose vials are stable for up to 14 days at room temperature without significant loss of potency.

CLASSIFICATION(S):
Thrombolytic

INDICATION(S):
Acute myocardial infarction for the lysis of occlusive coronary artery thrombi.

THERAPEUTIC ACTION(S):
1. When a clot is formed, an inactive plasma enzyme called plasminogen is incorporated into the clot. Body tissues, blood and introduced agents (tenecteplase) contain substances that can activate plasminogen to plasmin, an active enzyme. Once plasmin is formed, it can dissolve the clot by digesting fibrin threads and inactivating substances such as fibrinogen, prothombin, and factors V, VIII, and XII.
2. Binds to fibrin in a thrombus and converts the entrapped plasminogen to plasmin, initiating local fibrinolysis with limited systemic proteolysis.
3. Clot dissolution and reperfusion occur with a higher frequency when therapy is initiated earlier since most clots become more resistant to lysis with age.

ADVERSE EFFECT(S):

CVS
Hypotension, CHF, A-Fib, Arrhythmias

HEMAT
Internal hemorrhage involving intracranial and retroperitoneal sites, or the gastrointestinal, genitourinary, or respiratory tracts, superficial or surface bleeding

PRECAUTION(S):
1. Recent trauma (two to four weeks), including head trauma (no intracranial injury).
2. Recent traumatic or prolonged CPR (more than ten minutes).
3. Recent (two to four weeks) major organ surgery, biopsy, and/or punctures or non-compressible vessels.
4. Recent (less than six months) gastrointestinal or general bleed.
5. Pregnancy or early post partum state.
6. Diabetic hemorrhage, retinopathy or other hemorrhagic ophthalmic conditions.
7. Currently receiving oral anticoagulants.
8. Known bleeding disorder.
9. Infective endocarditis.
10. Terminal illness with low probability of prolonged survival (one week to one month)
11. Age, more than 75 years.

CONTRAINDICATION(S):

1. Previous history of hypersensitivity to reteplase.
2. Active internal bleeding.
3. History of hemorrhagic stroke or cerebrovascular event (less than six months).
4. Recent intracranial or intraspinal surgery or trauma (less than two months).
5. Intracranial neoplasm, arteriovenous malformation or aneurysm.
6. Severe uncontrolled hypertension (SBP > 180 mmHg or DBP > 110 mmHg).
7. Suspected aortic dissection.

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

Single bolus dose based on patient weight. Max 50 mg:

< 60 kg	30 mg
> 60 to < 70	35 mg
> 70 to < 80	40 mg
> 80 to < 90	45 mg
> 90	50 mg

Administer as an IV bolus over 5 seconds.

Following directions in kit transfer 10 ml SWI gently into vials using supplied syringe. Do not shake vials, gently swirl to assist dissolution.

PEDIATRIC DOSAGE:

Not indicated.

SUPPLIED FORM(S):

Kit containing tenecteplase vials, SWI and syringe.

ADDITIONAL INFORMATION:

1. Avoid any condition in which bleeding constitutes a substantial hazard or would be difficult to control because of its location.
2. Avoid IM injections and non-compressible arterial puncture.
3. Should serious bleeding occur, any concomitant heparin, anticoagulation, or antithrombotic therapy should be terminated immediately.

4. Assess for evidence of cardiac reperfusion (resolution of chest pain, resolution of baseline ECG changes, appearance of reperfusion arrhythmias, preserved left ventricular function).
5. Watch for clinical evidence of bleeding (hematuria, GI bleeding, gingival bleeding).
6. Monitor fibrinogen levels, fibrinogen degradation products and PT/PTT.
7. Inject into an IV line in which no other drugs are being administered.
8. Precipitation may occur when tenecteplase is administered in an IV line containing dextrose. Dextrose containing lines should be flushed with saline prior to and following tenecteplase bolus.
9. Patient care responsibilities during tenecteplase infusion:
    - Start 2 peripheral IVs in opposite limbs with NS TKVO.
    - Monitor vital signs and neurologic function q 15 minutes x 1 hour, then q 30 minutes for the duration of the infusion.
    - Check IV/venipuncture site q 30 minutes for subcutaneous bleeding or bruising.
    - Continuous cardiac monitoring is required (including serial 12 lead ECGs).
    - Inspect all secretions for hemorrhage.
    - Avoid taking BP in the arm with the IV sites or venipuncture (whenever possible).
    - Avoid arterial and venous puncture for 36 hours.
    - Observe for sign and symptoms of allergic/anaphylactic reactions.

tetanus toxoid

CLASSIFICATION(S):
Toxoid

INDICATION(S):
Active immunization against tetanus (primary immunization and reinforcing doses).

THERAPEUTIC ACTION(S):
Following injection, an antigenic response is induced causing formation of tetanus antibodies.

ADVERSE EFFECT(S):

Skin
Urticaria, angioneurotic edema

HEMAT
Pain, erythema, tenderness at injection site

Other
Transient fever, chills, malaise

PRECAUTION(S):
1. Patients receiving corticosteroids or immunosuppressants may show altered antigenic response.
2. Same site of injection should not be used more than once for primary series.
3. Do not use if product contains clumps after shaking.

CONTRAINDICATION(S):
1. Acute illnesses including febrile illness.
2. Hypersensitivity.
3. Allergies to thimerosol.
4. Pediatrics, less than six weeks old.

ROUTE(S) OF ADMINISTRATION:
Deep IM injection.

ADULT DOSAGE:
Primary Immunization
Total three dose series - two doses of **0.5 ml** IM given at four week intervals, third dose at six months to one year after second injection.

Booster Doses
0.5 ml at 10 year intervals

PEDIATRIC DOSAGE:
Less than six weeks of age – dosage same as adult.
SUPPLIED FORM(S):
Ampule: 0.5 ml cloudy suspension

ADDITIONAL INFORMATION:

1. Deltoid muscle or mid-lateral aspect of thigh are the recommended sites of injection.
2. Shake ampule before withdrawing the dose
3. Refrigerate.
4. Do not allow to freeze.
5. Minor illness (such as upper respiratory infection) does not preclude immunization.
6. Patients with unknown or uncertain previous vaccination histories should be considered to have had no previous tetanus toxoid doses.
7. Tetanus immune globulin may also be required for protection against tetanus if a wound is more than six hours old, contaminated with debris, infected, or was deep penetrating.

CLASSIFICATION(S):
Vitamin B_1

INDICATION(S):
1. Treatment or prophylaxis of thiamine deficiencies.
2. Chronic alcoholism and malnourished patients who require glucose (hypoglycemic patients).

THERAPEUTIC ACTION(S):
Combines with ATP to form thiamine pyrophosphate, a coenzyme required for carbohydrate and fat metabolism.

ADVERSE EFFECT(S):

CVS
Hypotension (from rapid injection.)

PRECAUTION(S):
1. Administer prior to or just after the administration of glucose ($D_{50}W$).
2. Rapid administration may cause vasodilation and hypotension.

CONTRAINDICATION(S):
Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
IV; IM

ADULT DOSAGE:
100 mg slow IV over 2-5 minutes; **100 mg** IM

PEDIATRIC DOSAGE:
Not applicable

SUPPLIED FORM(S):
Vial: 1000 mg/10 mL (100 mg/mL)
Ampule: 100 mg/mL

ADDITIONAL INFORMATION:

1. Severe thiamine deficiency can reduce glucose utilization by half and may precipitate Wernicke's encephalopathy or Korsakoff's syndrome.
2. Wernicke's encephalopathy: is an acute and irreversible disorder associated with chronic alcoholism. It is characterized by poor voluntary muscle coordination, eye muscle weakness and mental derangement.
3. Korsakoff's syndrome is a frequent result of chronic alcoholism. It is characterized by disorientation, illusions, hallucinations and painful extremities.

thiopental **Pentothal**

CLASSIFICATION(S):
Barbiturate Anesthetic; Anticonvulsant

INDICATION(S):
1. Sedation for assisting with endotracheal intubation (RSS/RSI).
2. Sedation for short term painful procedures.

THERAPEUTIC ACTION(S):
1. Produces anesthesia by enhancing responses to gamma-aminobutyric acid (GABA), diminishing glutamate (GLU) responses, and directly depressing excitability by increasing membrane conductance (an effect reversed by the GABA antagonist picrotoxin), thereby producing a net decrease in neuronal excitability to provide anesthetic action .
2. Onset of action is 30-40 seconds with IV administration; duration of action 10-30 minutes.

ADVERSE EFFECT(S):

CNS
Seizures, anxiety, headache

RESP
Respiratory depression, apnea, laryngospasm, bronchospasm

CVS
Peripheral vascular collapse, dysrhythmias, hypotension, (-) inotropic effects

GI
N/V, salivation

PRECAUTION(S):
1. Impaired respiratory, circulatory, cardiac, renal and hepatic states.
2. Cardiovascular disease.
3. Asthma.
4. Potentiates respiratory depressive effects of narcotics and benzodiazepines.

CONTRAINDICATION(S):
1. Barbiturate hypersensitivity.
2. Hypotension.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
50-75 mg slow IV push over 20-40 second intervals, repeat at **25-50 mg** if required

PEDIATRIC DOSAGE:
2-4 mg/kg

SUPPLIED FORM(S):
Vial: 1 g/50 mL vial

ADDITIONAL INFORMATION:
1. Have airway equipment readily available.
2. Discard unused drug after 24 hours.
3. Ultra-short acting barbiturate.
4. Decreases CNS metabolic rate and ICP.

vasopressin **Pitressin**

CLASSIFICATION(S):
Pituitary Hormone

INDICATION(S):
1. Alternative pressor to epinephrine in the treatment of adult shock-refractory VF/Pulseless VT.
2. Hemodynamic support in treatment of vasodilatory shock (i.e. septic shock).

THERAPEUTIC ACTION(S):
1. Potent peripheral vasoconstrictor resulting in increased peripheral vascular resistance.
2. Promotes water reabsorption in the renal tubular epithelium.
3. Promotes smooth muscle contraction throughout the vascular bed.

ADVERSE EFFECT(S):

CNS
Lethargy, confusion

RESP
Bronchoconstriction

CVS
Hypertension, chest pain, peripheral vasoconstriction (coronary and mesenteric vessels)

Fluid & Electrolyte
Water retention, hyponatremia

GI
Abdominal cramps, N/V

Other
Tremor, sweating, allergic reaction, blanching of shin

PRECAUTION(S):
1. Epilepsy.
2. Asthma.
3. Renal disease.
4. Cardiovascular disease.
5. Elderly/pediatric patients.

CONTRAINDICATION(S):

1. Chronic nephritis with nitrogen retention.
2. Ischemic heart disease.
3. PVC's.
4. Hypersensitivity.

ROUTE(S) OF ADMINISTRATION:
IV; IV infusion

ADULT DOSAGE:
VF/Pulseless VT
40 units diluted in 10 ml NS IV push X 1 dose only

Vasodilatory Shock
0.02 – 0.1 units/minute

Add 20 units to 100 ml NS to make a concentration of 0.2 units/ml

0.02 units/minute = 6 ml/hr
0.04 units/minute = 12 ml/hr
0.06 units/minute = 18 ml/hr
0.1 units/minute = 30 ml/hr

PEDIATRIC DOSAGE:
Not indicated.

SUPPLIED FORM(S):
Ampule: 1 ml (20 units/ml)

ADDITIONAL INFORMATION:

1. Normal saline is the preferred diluent as it may decrease potential for water intoxication.
2. Continuously monitor ECG and vital signs q 3-5 minutes during infusion.
3. Monitor baseline serum electrolytes q 2-4 hours, urine osmolarity q 12-16 hours, and fluid balance.
4. Frequently monitor IV site for extravasation.

CLASSIFICATION(S):
Nondepolarizing Neuromuscular Blocking Agent

INDICATION(S):
1. To provide skeletal muscle relaxation and paralysis to facilitate endotracheal intubation.
2. Situations include an unprotected airway or respiratory failure in the following conditions:
    - Head injury.
    - Drug overdose.
    - Status epilepticus.
    - Agitated or combative patients.
    - Trismus.
    - Multiple traumas.
    - Severe respiratory distress.

THERAPEUTIC ACTION(S):
1. Competes against acetylcholine for cholinergic receptors at the motor end-plate. Once bound to receptors, no response is produced which results in absence of muscle fasciculation before flaccid paralysis.
2. Onset of action: 60-120 seconds, duration of action: 45-65 minutes.
3. Vecuronium has no effect on consciousness, pain threshold, and cognitive activity of the brain.

ADVERSE EFFECT(S):
RESP
Bronchospasm, rhonchi

CVS
Hypotension, hypertension, tachycardia, dysrhythmias (all incidences are less than one percent)

GI
N/V

PRECAUTION(S):
1. Cardiovascular, hepatic or renal insufficiency.
2. Neuromuscular disease (myasthenia gravis).
3. Does not stop neuronal seizure activity (which may be undetectable in a paralyzed patient)

4. Geriatric patients (more than 65 yrs) show a longer onset time and duration of blockade than adults at equivalent doses.
5. Possibility for a difficult intubation (i.e. obesity).

CONTRAINDICATION(S):

1. Vecuronium or bromide allergy.
2. Hypersensitivity.
3. Any situation where you do not have adequate airway control (inability to ventilate with a BVM).
4. Upper airway obstruction (partial or complete).

ROUTE(S) OF ADMINISTRATION:

IV

ADULT DOSAGE:

RSI

0.1 mg/kg, repeat at **0.05 mg/kg** prn

Defasciculating Dose

0.01 mg/kg

PEDIATRIC DOSAGE:

0.1 mg/kg

SUPPLIED FORM(S):

Vial: 10 mg of powdered

Reconstitute with 10 mL bacteriostatic water or NS to provide a concentration of 1 mg/mL.

ADDITIONAL INFORMATION:

1. Chronic use of antiepileptic agents such as carbamazepine (Tegretol) or phenytoin (Dilantin) may shorten the length of neuromuscular blockade.
2. Young children less than one year of age may be less sensitive than adults and may require a slightly higher dose.
3. Vecuronium should not be administered before sedation is induced.
4. May be reversed by neostigmine, endrophonium, or pyrridostigmine as these agents have anticholinesterase activity allowing levels of acetylcholine to rise at the postsynaptic receptor.
5. Reversal of a nondepolarizing neuromuscular blocking agent should not be attempted until some movement is noted or a peripheral nerve stimulator is used to demonstrate return of function.

6. Return of muscular movement is usually noted approximately 30-60 minutes after initial flaccid paralysis.

verapamil **Isoptin**

CLASSIFICATION(S):
Antiarrhythmic (calcium channel blocker); Antihypertensive

INDICATION(S):
1. Second line treatment of narrow complex PSVT.
2. Used to control the ventricular response in atrial fibrillation or flutter.

THERAPEUTIC ACTION(S):
1. Verapamil inhibits calcium ion entry through select voltage-sensitive areas termed "slow channels" across cell membranes. With the reduction of intracellular calcium concentrations in cardiac and vascular smooth muscle cells, dilation of the coronary arteries, peripheral arteries and arterioles, and decreased vascular resistance result. There may also be a reduction of heart rate, decrease in myocardial contractility (negative inotropic effects), and slowed AV nodal conduction.
2. Negative dromotropic.
3. Negative chronotropic.
4. Decrease atrial automaticity.

ADVERSE EFFECT(S):

CNS
Dizziness, headache, fatigue

CVS
Hypotension, bradycardia, AV blocks

GI
Constipation, N/V

PRECAUTION(S):
1. Use with anything that slows AV conduction or depresses myocardial function.
2. Cardiovascular, hepatic and renal insufficiency.
3. Elderly patients.

CONTRAINDICATION(S):
1. Cardiogenic shock, AMI, CHF.
2. Concomitant use of beta blockers or digitalis (wait several hours), including patients on oral beta blockers (may cause severe hypotension).
3. AV blocks (conduction disturbances).
4. Hypotension.

5. Wide complex tachycardia.
6. Sick sinus syndrome (may interfere with sinus-node impulse generation and may induce sinus or sinoatrial block).
7. Patients with atrial flutter of atrial fibrillation and an accessory bypass tract (WPW, LGL). Verapamil may result in significant acceleration of ventricular response.

ROUTE(S) OF ADMINISTRATION:
IV

ADULT DOSAGE:
Initial
2.5-5 mg IV over 2-3 minutes, repeat dose of **5-10 mg** q 15-30 minutes, max 20 mg

PEDIATRIC DOSAGE:
1-15 years
0.1-0.3 mg/kg slow IV push, max 5 mg

Not to be used in infants < 1 year of age

SUPPLIED FORM(S):
Ampule: 5 mg/2 mL (2.5 mg/mL)

ADDITIONAL INFORMATION:
1. Keep calcium chloride available should overdose occur (8-16 mg/kg).
2. Consider pretreatment with calcium chloride (2-4 mg/kg).
3. The concomitant administration of verapamil with beta blockers can result in severe adverse effects (the depressant effects on myocardial contractility, heart rate and AV conduction may be additive).
4. May decrease myocardial contractility and may exacerbate CHF in patients with LV dysfunction.