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**CHAPTER 8**

**PREHOSPITAL MEDICATIONS**

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## INTRODUCTION TO PREHOSPITAL DRUGS

All care, in regard to the administration of medications, assessment, and performance of procedures, shall be provided in accordance with the practitioner's scope of practice, defined by the most recent version of the Colorado Board of Medical Examiners Rule 500. As such, specific care guidelines will not be delineated within these protocols, except to denote restrictions on the scope of practice. If allowed by Rule 500, we will expect the practitioners to follow appropriate guidelines.

### Basic prehospital drugs

- Albuterol
- Aspirin
- Charcoal
- Dextrose, oral preparations
- Oxygen

Assist patient with:

- epinephrine (Epi-Pen) or anaphylaxis kit
- Inhalers
- Nitroglycerin

Advanced drugs suitable for standing-order in some circumstances OR direct-order administration.

Adenosine	Influenza Virus Vaccine
Albuterol	Ipratropium Bromide
Amiodarone	IV solutions
Atropine	Lidocaine
Benzocaine	Lidocaine Viscous
Benzodiazepines	Magnesium sulfate
Calcium	Morphine
Charcoal	Naloxone
Dexamethasone	Ondansetron
Dextrose, IV preparations	Phenylephrine nasal spray
Diltiazem	Racemic Epinephrine
Diphenhydramine	Sodium bicarbonate (drowning, cardiac arrest)
Dopamine	Succinylcholine
Epinephrine	Tetanus-Diphtheria Vaccine
Etomidate	Topical Ophthalmic Anesthetics
Fentanyl	Tuberculin PPD
Furosemide	Vasopressin
Glucagon	Vecuronium Bromide
Haldol	Verapamil
Hepatitis B Vaccine	

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## **ADENOSINE (ADENOCARD)**

### **Pharmacology and actions**

Adenosine is a naturally occurring purine nucleoside. Adenosine slows conduction time through the AV node. This results in an interruption of AV–nodal reentry pathways. It can restore NSR in patients with PSVT.

### **Indications**

- A. PSVT. (Including PSVT associated with Wolff–Parkinson–White Syndrome or other accessory bypass tracts.)
- B. Tachycardia, uncertain etiology, to determine underlying dysrhythmia.

### **Precautions**

- A. Contraindicated in patients with second or third degree A–V block or sick sinus syndrome. Underlying blocks or conduction defects can be associated with prolonged sinus arrest when using adenosine.
- B. Adenosine has a very short half–life (< 10 seconds). If bolus administration is not rapid, followed by a fluid push, the drug may have no effect, simply because it has been metabolized.

### **Administration**

- A. **Adults**  
Initial dose – 6 mg rapid IV push, followed immediately by a saline bolus of 10–20 ml via separate syringe.  
Second dose, if necessary after 1–2 minutes – 12 mg rapid IV push followed by saline flush. This may be repeated once if necessary.
- B. **Pediatrics**  
Initial dose – 0.1 mg/kg rapid IV push (max 6 mg), followed immediately by a 3–5 ml saline flush.  
Second dose, if necessary after 1–2 minutes – 0.2 mg/kg rapid IV push, (max 12 mg) followed by saline flush.

### **Side effects and special notes**

- A. At the time of conversion many patients will have flushing, dyspnea, chest pain, or apprehension. These symptoms are transient, but can be frightening. Reassurance will be helpful, particularly in advance.
- B. The cardiac rhythm after administration of adenosine can undergo various dysrhythmias prior to converting to sinus rhythm. A brief period of asystole, bradycardia or transient ectopy is common.

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## ALBUTEROL

### Pharmacology and actions

Albuterol is a relatively selective Beta2 adrenergic stimulator. The effects are predominantly on bronchial smooth muscle; however there are also  $\beta_2$  receptors in the heart muscle. Clinical effects most frequently include

- A. Bronchial dilatation, improvement in FEV1 and peak flow.
- B. Tachycardia.
- C. Peripheral vasodilatation.
- D. Hyper or hypotension possible.

### Indications

As a bronchodilator for asthma, and for reversible bronchospasm associated with bronchitis and emphysema (COPD).

### Precautions

- A. Use with caution in patients with history of cardiovascular disorders such as hypertension, CAD, CHF, or hyperthyroidism.
- B. May lower seizure threshold in susceptible patients.
- C. Patients over 40 should have cardiac rhythm monitored during treatment.
- D. Paradoxical bronchospasm has been reported as a response to this drug. If it appears the patient is getting worse – discontinue the treatment.

### Administration

- A. Available as premixed solution 0.083% albuterol or 0.83 mg/ml or 2.5 mg/inhalation treatment.
  - 1. **Adults** – administer by nebulizer 3 ml (2.5 mg for 2 yrs to adult).
  - 2. **For children under 2** – use half of premixed solution with 2 ml of saline.
- B. May repeat or even administer as a continuous nebulization during transport if necessary.

### Side effects and special notes

- A. Nervousness, tremors, tachycardia and nausea are frequent side effects.
- B. May produce hypertension, palpitations, angina, or dysrhythmias.
- C. Cardiac effects may be more pronounced in patients who are taking MAO inhibitors or tricyclic antidepressants.
- D. Basic prehospital care providers may be asked to assist with administration of the patient's inhaler. Contact base physician to assess the type of inhaler and whether appropriate for current condition.
- E. EMT–Basics may administer abuterol for asthma, and for reversible bronchospasm associated with bronchitis and emphysema (COPD) with a direct physician order.

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## **AMIODARONE (CORDARONE)**

### **Pharmacology and actions**

Amiodarone is a complex, wide-spectrum medication which is typically categorized as a Class III antiarrhythmic due to its lengthening of the effective refractory period by prolongation of the action potential duration. However, it also demonstrates strong sodium channel antagonism, some calcium and potassium channel inhibition, and noncompetitive blockade of alpha and beta-adrenergic receptors. While the fact that this medication works through a variety of different mechanisms increases its effectiveness in treating dysrhythmias when other medications may be ineffective, this also increases the proarrhythmogenicity and side effect potential of the medication. Amiodarone is a pro-drug, which requires extensive hepatic metabolization in forming its pharmacologically active metabolite. Amiodarone is highly lipid soluble, widely distributed throughout the body, and undergoes a very slow elimination half-life (months) while being eliminated through the lacrimal glands, skin, and biliary system, rather than through the kidneys.

### **Indications**

- A. Ventricular fibrillation or pulseless ventricular tachycardia.
- B. Recurrent, hemodynamically unstable, ventricular tachycardia unresponsive to cardioversion.

### **Precautions**

- A. Although amiodarone may be effective on a variety of different dysrhythmias, due to the potential complications associated with this medication, it will only be considered for use in the patient who is experiencing recurrent, lethal, ventricular dysrhythmias, as described above.
- B. Amiodarone causes prolongation of the QT interval, and may induce Torsades de Pointes. This effect may be exacerbated in the presence of other medications that cause QT prolongation (i.e., procainamide, etc).
- C. Hypotension may develop, however, this effect is primarily seen with multiple and higher doses of the medication given over a period of hours.

### **Administration**

- A. **Adult Cardiac Arrest** – Dilute 300 mg of amiodarone in 20–30 ml of NS or D5W and administer IV/IO push. If no response within 3–5 minutes, administer 150 mg of amiodarone IV/IO push.
- B. **Adult Unstable V-Tach** – Administer 150 mg over 10 minutes. This dose may be repeated after 10 minutes, if the first dose was not effective.
- C. **Pediatric Cardiac Arrest** – 5 mg/kg (max 300 mg) IV/IO bolus. You may repeat this twice (total of 15 mg/kg), at 5 minute intervals, if needed.
- D. **Pediatric Unstable V-Tach** – Administer 5 mg/kg over 20 minutes. Do not repeat.

### **Side effects and special notes**

If the patient develops Torsades de Pointes, treat with catecholamines and magnesium.

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## **ASPIRIN (ACETYLSALICYLIC ACID)**

### **Pharmacology and actions**

Aspirin is an NSAID which exhibits analgesic, anti-inflammatory, antipyretic, and anti-thrombotic activity. Like the analgesic and anti-inflammatory effects, the effects of aspirin on platelets appear to be mainly associated with an inhibition of prostaglandin synthesis. Aspirin irreversibly inactivates the enzyme cyclooxygenase in circulating platelets. The inactivation of this enzyme is currently thought to prevent platelet synthesis of prostaglandin endoperoxides and thromboxane A<sub>2</sub>, compounds which induce platelet aggregation and constrict arterial smooth muscle. Platelet cyclooxygenase has been found to be inhibited by single oral aspirin doses of 80–300 mg.

The administration of aspirin to patients who can tolerate its use, during the acute phase of a myocardial infarction to prevent post-thrombolytic reocclusion, reinfarction, or death (“acute secondary prophylaxis”) is strongly supported.

### **Indications**

The field indication for aspirin use will be limited to the adult patient believed to be experiencing an acute myocardial infarction.

### **Precautions**

- A. Patients who have experienced urticaria, angioedema, bronchospasm, severe rhinitis, or shock with the use of aspirin, or other NSAID’s represent an absolute contraindication to the use of aspirin in the field.
- B. Patients who have a history of severe GI bleeding, asthma, CNS lesions, bleeding disorders, or anticoagulant use (i.e. Coumadin, Plavix, heparin, etc.) may represent a relative contraindication to a single dose of aspirin. Contact the receiving physician for orders.

### **Administration**

Two to four, 81 mg, chewable tablets should be administered by mouth.

### **Side effects and special notes**

- A. May cause gastric upset in especially sensitive individuals.
- B. May cause an increased risk of bleeding when combined with anticoagulants and thrombolytic agents.

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## ATROPINE

### Pharmacology and actions

Atropine is a parasympathetic or cholinergic blocking agent. As such, it has the following effects

- A. Increases heart rate (by blocking vagal influences).
- B. Increases conduction through A–V node.
- C. Reduces motility and tone of GI tract.
- D. Reduces action and tone of urinary bladder (may cause urinary retention).
- E. Dilates pupils.

NOTE: This drug blocks cholinergic (vagal) influences already present. If there is little cholinergic stimulation present, effects will be minimal.

### Indications

- A. To counteract excessive vagal influences responsible for some bradysystolic and asystolic arrests.
- B. To increase heart rate in hemodynamically significant bradycardias.
- C. To improve conduction in 2nd and 3rd degree heart block or in pacemaker failure.
- D. As an antidote for some insecticide exposures (e.g., organophosphates) and nerve gases with symptoms of excess cholinergic stimulation: salivation, constricted pupils, bradycardia, tearing, diaphoresis, vomiting, and diarrhea.
- E. As an adjunct with RSI.

### Precautions

Bradycardias in the setting of an acute MI are common and may be beneficial. Do not treat unless there are signs of poor perfusion (low blood pressure, mental confusion). Chest pain could be due to an MI or to poor perfusion caused by the bradycardia itself.

People do well with chronic 2nd and 3rd degree block. Symptoms occur mainly with acute change. Treat the patient, not the rhythm.

Pediatric bradycardias are most commonly secondary to hypoxia. Correct the ventilation first. Treat the rate only if improved ventilation does not increase the rate.

Bradycardia in the trauma patient, as with the pediatric patient, is usually a result of underlying condition. It may be secondary to a cardiac contusion, or may be due to critical CNS, cardiac or respiratory decompensation. Treat the underlying cause!

### Administration

- A. Asystole
  - 1. **adult** – 1.0 mg IV, repeat in 3–5 minutes to total of 0.04 mg/kg.
  - 2. **pediatric** – 0.02 mg/kg per dose IV (minimum dose of 0.1 mg and a max of 1.0 mg in child, Max of 0.04 mg/kg in an adolescent).
- B. Symptomatic bradycardia
  - 1. **adult** – 0.5–1.0 mg IV, repeated if needed at 5 minute intervals to a heart rate of 60 or total of 0.04 mg/kg.
  - 2. **pediatric** – 0.02 mg/kg per dose IV.
- C. RSI in pediatric patients 0.02 mg/kg IV prior to succinylcholine.

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- D. May be given via ET tube at double the dose.
- E. For symptomatic insecticide exposures: contact base or PCC for dosage (usually begin with 2 mg IV and titrate). Total required dose may be massive.

**Side effects and special notes**

- A. Remember in cardiac arrest situation that atropine dilates pupils.
- B. Atropine should not be administered in less than 0.5 mg dose for adults to prevent a parasympathomimetic response that would further slow the heart rate.

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## **BENZOCAINE, 20% TOPICAL AEROSOL**

### **Pharmacology and actions**

Benzocaine is a local anesthetic of the ester type. It decreases the permeability of sodium ions in the neuronal membrane thereby blocking the initiation and conduction of nerve impulses. It is poorly absorbed after topical application, reducing the potential for systemic effect. Most frequent clinical effects include

- A. Topical anesthetic for the relief of mild skin conditions.
- B. Topical anesthetic for decreasing pharyngeal and tracheal reflexes when pharyngeal or nasal airways are in place.

### **Indications**

Topical anesthetic to reduce hyperactive pharyngeal and tracheal reflexes exacerbated by the placement of endotracheal or nasogastric tubes

### **Precautions**

- A. Contraindicated in patients with known allergy or hypersensitivity to Benzocaine.
- B. May cause burning or stinging. Discontinue use if erythema, itching, rash, or edema occurs.
- C. Do not use in infants under 2 year of age.
- D. Use with caution in pregnant women or nursing mothers.

### **Administration**

- A. Apply evenly to mucosal tissue in sprays of less than 1 second. May be repeated as necessary to suppress hyperactive reflexes.
- B. May apply to endotracheal or nasogastric tubes before insertion.

### **Side effects and special notes**

- A. Burning, stinging, pruritus, tenderness, erythema, rash, urticaria, and edema may occur.
- B. May compromise gag and carinal reflexes. Be prepared to manage the patient's airway.

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## **BENZODIAZEPINES**

### **DIAZEPAM (Valium) LORAZEPAM (Ativan) MIDAZOLAM (Versed)**

#### **Pharmacology and actions**

Benzodiazepines work by enhancing the effect of the inhibitory neurotransmitter gamma-amino butyric acid (GABA) at GABA<sub>A</sub> receptors, resulting in a depressant effect on the central nervous system.

#### **Indications**

Seizures, Anxiety, Muscle Spasms, combative behavior. Premedication for medical procedures.

#### **Administration**

##### **Adult**

- Lorazepam 1 mg IV/IO or 2 mg IM; may repeat once in 10 minutes, or
- Midazolam 2 mg IV/IO/IM/Intranasal; may repeat once in 10 minutes, or
- Diazepam 2-5 mg IV/IO or 5 mg IM; may repeat once in 10 minutes.

##### **Pediatric**

- Lorazepam 0.1 mg/kg IV/IO/IM (single maximum dose 2 mg), or
- Midazolam 0.1 mg/kg IV/IO/IM or 0.2 mg/kg Intranasal (single maximum dose 6 mg), or
- Diazepam 0.2 mg/kg IV/IO or 0.5 mg/kg PR (single maximum dose 5 mg IV or 10 mg PR)

#### **Side effects and special notes**

- A. Amnesia
- B. Risk of side effects of benzodiazepines is greatest in the elderly.

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## **CALCIUM**

### **Pharmacology and actions**

- A. Increases contractility of cardiac muscle.
- B. May increase ventricular automaticity and excitability.
- C. Decreases heart rate.
- D. Produces effects similar to and additive with those of digitalis.

### **Indications**

- A. Hypocalcaemia.
- B. Hyperkalemia.
- C. Hypermagnesemia.
- D. Calcium channel blocker toxicity.
- E. Hydrofluoric Acid burns (Calcium Gluconate)
- F. Hydrogen fluoride or other fluoride systemic toxicity

### **Precautions**

- A. Do not add to IV in rapid succession with sodium bicarbonate (precipitates calcium salt).
- B. In digitalized patients, additive effects may cause ventricular fibrillation or asystole.

### **Administration**

- A. Calcium chloride (10% solution) 1 ampule or prefilled syringe = 10 ml = 13.6 mEq calcium = 1000 mg calcium chloride.
  - 1. Adult dose – 10 mg/kg calcium chloride slow IV (7 ml 10% solution for 70 kg patient).
  - 2. Pediatric dose – 20 mg/kg calcium chloride (0.2 ml/kg) slow IV to a maximum of 2 ml.
- B. Calcium Gluconate (2.5–10%) commercially prepared, or mixed with water soluble lubricant. Apply topically to affected area.
- C. Other indications – See Haz Mat Chapter.

### **Side effects and special notes**

- A. If heart is beating, rapid administration of calcium salts can produce bradycardia or asystole.
- B. May increase cardiac irritability (PVCs), particularly in the presence of digitalis.
- C. Local infiltration into the subcutaneous tissue will cause tissue necrosis. Be sure the IV is secure.

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## CHARCOAL

### Pharmacology and actions

Oral activated charcoal adsorbs drugs and chemicals on the surface of the charcoal particles. This adsorption is almost irreversible and prevents absorption and toxicity. Activated charcoal is produced by the destruction of various organic materials (wood, petroleum) then treated at high temperature with activating agents (steam or CO<sub>2</sub>) to increase its adsorptive capacity. Activation occurs by removing previously adsorbed materials and by reducing particle size, thereby increasing the surface area.

### Indications

- A. Toxic ingestion of chemicals (other than acids, alkalis or hydrocarbons).
- B. Overdose of medications (other than iron or lithium).

### Precautions

- A. Do not administer soon after ipecac since it may come up rather violently. It is very difficult to clean from clothing and surroundings.
- B. Do not administer to comatose patient; ABCs will take precedence in those patients.

### Administration

- A. **Adult** – 1 Gm/kg activated charcoal orally
- B. **Pediatric** – 1 Gm/kg activated charcoal orally (Direct Physician Order Only)

### Side effects and special notes

- A. Charcoal is inert with very few side effects, but may be constipating.
- B. Charcoal is useful in many ingestions. It is most effective when administered soon after the ingestion, but may still be effective many hours later.
- C. There are some ingestions that are not adsorbed by charcoal (iron, lithium, alcohols, and caustics). Contact base physician to discuss specific ingestions. Order for administration may also come from PCC if family has been in communication with them or PCC easier to contact at 800-222-1222.

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## DEXAMETHASONE

### **Pharmacology and actions**

Dexamethasone is a steroid compound which inhibits inflammatory response of tissues injured from mechanical, chemical, infectious, inflammatory or other causes. It may lessen swelling in cells of the brain or spinal column after trauma or hypoxia. In patients with asthma, steroids stabilize cells, preventing release of histamines and other mediators of bronchospasm. Any improvement will occur hours, not minutes, after administration.

Note: Steroids have many complex effects, particularly when used over a period of time. A single dose probably does not have significant side effects.

### **Indications**

- A. Refractory asthma.
- B. Anaphylactic shock.

### **Contraindications**

Not indicated for acute spine and closed head injury patients.

### **Administration**

- A. **Adults:** 10 mg dexamethasone IV or IM.
- B. **Children:** 0.6 mg/kg IV or IM.

### **Side effects and special notes**

Dexamethasone, unlike most prehospital drugs, is not expected to have effects during the time of transport. Early use may be indicated to minimize the time delay between injury and in-hospital therapeutic effect.

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## **DEXTROSE (Intravenous)**

### **Pharmacology and actions**

Glucose is the body's basic fuel. It produces most of the body's quick energy. Glucose use is regulated by insulin, which stimulates storage of excess glucose from the bloodstream, and by glucagon, which mobilizes stored glucose in the bloodstream.

### **Indications**

- A. Any illness or altered mental state in a known diabetic which might be caused by hypoglycemia.
- B. Unconscious patient when a history is unobtainable and hypoglycemia cannot be excluded.
- C. In patients with any focal neurologic deficit or altered state of consciousness and a blood glucose < 60 mg/dl.
- D. Patient with active seizure or cardiac arrest when history is unobtainable.
- E. Pediatric patients (less than 3) with signs of shock.
- F. Hypothermia, generalized.
- G. Any clinical condition of concern for hypoglycemia and blood glucose reading less than 60 mg/dl.

### **Precautions**

- A. Test 1–2 drops of blood prior to administration of dextrose.
- B. Extravasation of dextrose will cause necrosis of tissue. IV should be secure and free return of blood into the syringe or tubing should be checked 2–3 times during administration.

### **Administration**

- A. Test blood for glucose level.
- B. **Adult** – 50 ml ampule 50% dextrose (1 ml/kg) IV into secure vein if patient unable to tolerate oral fluids.
- C. **Pediatric** – 2 ml/kg 25% dextrose (dilute 50:50 with saline) into secure IV.
- D. **Neonates** – 5 ml/kg of 10% dextrose (dilute 1:5 with saline) into secure IV.
- E. Give 50% dextrose solution orally (or sugar plus juice, honey, molasses, syrup) if patient is awake.

### **Side effects and special notes**

- A. Dextrose is remarkably free of side effects for most patients and should be used whenever a question of hypoglycemia exists.
- B. In an unconscious patient, blood should be drawn for glucose determination and a drop should be tested. If results are low or equivocal, administer dextrose. Dextrose should be omitted only with a clear cut test reading over 100 mg/dl.
- C. Effect is delayed in elderly people with poor circulation or patients who have been hypoglycemic for a prolonged period of time.
- D. Do not draw blood for glucose determination from site proximal to an IV containing glucose or dextrose.

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## **DEXTROSE (ORAL)**

### **Pharmacology and actions**

Raises the blood glucose level. Oral glucose may restore the level of sugar necessary for normal organ function, especially the brain.

### **Indications**

Patient with altered mental status who is poorly responsive or confused may be given oral glucose. Insure the patient's breathing is adequate and that the patient has the ability to swallow.

### **Precautions**

Contraindicated in an unconscious patient or in a patient who is unable to swallow. Aspiration of the glucose into the lungs could occur in such a patient.

### **Administration**

- A. Administer one tube gradually into the mouth. Tubes contain 15–30 grams of glucose.
- B. Squeeze oral glucose from tube onto a tongue depressor. Place the tongue depressor between the patient's cheek and gum. Alternatively, the glucose can be squeezed directly from the tube into the patient's mouth between the cheek and gum.

### **Side effects and special notes**

- A. Assure that signs of altered mental status are present and that other causes for the patient's condition beside diabetes have been considered, hypoxia, stroke, infections, poisonings, head trauma, etc. Assess and assure that the patient is conscious and able to swallow.
- B. There are no side effects if used properly
- C. Can be aspirated into the lungs
- D. Intermediate and EMTs may administer oral glucose

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## **DILTIAZEM (CARDIZEM)**

### **Pharmacology and actions**

Diltiazem is a calcium channel blocker which demonstrates negative dromotropic properties at both the SA and AV node. This, coupled with its moderate negative inotropic and peripheral vasodilative properties, tends to make diltiazem a favorable medication for heart rate control with less severe side effects than commonly demonstrated by other medications of this class. Diltiazem is hepatically metabolized and excreted through both the renal and biliary systems.

### **Indications**

- A. Reentrant supraventricular tachydysrhythmias.
- B. Atrial fibrillation or atrial flutter with a rapid ventricular response.

### **Precautions**

- A. If appropriate for the presenting dysrhythmia, the use of vagal maneuvers and adenosine are safer, and should be attempted before diltiazem is considered.
- B. Patients who are HEMODYNAMICALLY UNSTABLE (hypotension or congestive heart failure) should be CARDIOVERTED IMMEDIATELY, rather than medicated with diltiazem.
- C. Use with extreme caution in those patients who are taking oral beta-blockers, and DO NOT administer IV beta blockers and calcium channel blockers concomitantly.
- D. Contraindicated in patients with sick sinus syndrome or AV heart block in the absence of a functioning artificial pacemaker.
- E. Absolutely contraindicated in any wide-QRS tachycardia resulting from a poisoning or drug overdose, Wolf-Parkinson-White (WPW) syndrome associated with either atrial flutter or atrial fibrillation, or ventricular tachycardia.
- F. Contraindicated in hypotensive patients, and should be used with great caution in patients prone to diminished cardiovascular preload.

### **Administration**

- A. Adult – Administer 0.25 mg/kg (maximum of 20 mg) IV slowly over 2–3 minutes. If no response after 15 minutes, an additional dose of 0.35 mg/kg (max of 25 mg) IV may be given slowly over 2–3 minutes. Side effects and special notes
- A. Transient drops in arterial pressure are expected. If hypotension is severe or prolonged, consider treatment with IV fluids, dopamine, calcium, or glucagon.
- B. Electrical activity through the SA and AV nodes depends to a significant degree upon calcium influx through the channel. By blocking that response, patients with preexisting nodal disease can develop sinus arrest, increased AV block, complete heart block, and asystole. Treatment may require calcium, catecholamines, atropine, glucagon or pacing.
- C. The administration of diltiazem to the patient in ventricular tachycardia may result in ventricular fibrillation and death. If you have any doubt about the origin of the tachycardia, utilize other therapeutic measures.

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## **DIPHENHYDRAMINE (BENADRYL)**

### **Pharmacology and actions**

- A. An antihistamine which blocks action of histamine released from cells during an allergic reaction.
- B. Direct CNS effects which may be stimulant, or more commonly, depressant, depending on individual variation.
- C. Anticholinergic, antiparkinsonian effect, which is used to treat acute dystonic reactions to antipsychotic drugs (e.g., Haldol, Thorazine, Compazine, droperidol). These reactions include – oculogyric crisis, acute torticollis, and facial grimacing.

### **Indications**

- A. Anaphylaxis and severe allergic reactions.
- B. To counteract acute dystonic reactions to antipsychotic drugs.

### **Precautions**

May have additive effect with alcohol or other depressants.

### **Administration**

- A. **Adult** – 50 mg slow IV push or deep IM.
- B. **Pediatric** – 2 mg/kg slow IV or deep IM (not to exceed 50 mg total).

### **Side effects and special notes**

- A. Benadryl may also be useful for acute dystonic reactions. These reactions can be emotionally and physically trying, but are seldom life-threatening. It may allow transport of a less agitated and anxious patient.
- B. Benadryl occasionally is used prophylactically with haloperidol to increase sedation, and decrease the risk of dystonic reactions.

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## **DOPAMINE (INTROPIN)**

### **Pharmacology and actions**

Dopamine is a chemical precursor of norepinephrine. It occurs naturally in man, and has both alpha and beta receptor stimulating actions, as well as action on specific dopaminergic receptors. At high doses, actions are very similar to those of norepinephrine (Levophed). At lower dose levels, the differential effects allow cardiac stimulation and support of blood pressure without increasing oxygen demand and vasoconstricting vital organs as much as earlier vasopressors. In general, the following actions are seen

- A. 1–2 mcg/kg/min – dilates renal and mesenteric blood vessels (no effect on heart rate or blood pressure).
- B. 2–10 mcg/kg/min – beta effects on heart usually increase cardiac output without increasing heart rate or blood pressure.
- C. 10–20 mcg/kg/min – alpha peripheral effects causes peripheral vasoconstriction and increased blood pressure.
- D. 20–40 mcg/kg/min – alpha effects reverse dilatation of renal and mesenteric vessels with resultant decreased flow.

### **Indications**

- A. Hypotension which is hemodynamically significant in the absence of hypovolemia (i.e., cardiogenic shock).
- B. Septic or neurogenic shock when unresponsive to other measures (secondary use only).

### **Precautions**

- A. DOPAMINE IS CONTRAINDICATED IN HYPOVOLEMIC SHOCK. Pressor agents make tissue hypoxia worse in the presence of hypovolemia. Because even some cardiac patients may be hypovolemic from diuretics and poor fluid intake, careful evaluation is necessary. Invasive monitoring is often the only way to differentiate forms of shock in the elderly and treatment with dopamine is, therefore, indicated in the field only in severely unstable patients with evidence of increased venous pressure.
- B. Dopamine is best administered by an infusion pump to accurately regulate rate. This is another reason it is hazardous for field use. Monitor closely.
- C. May induce tachydysrhythmias, in which case, infusion should be decreased or stopped.
- D. At low doses, decreased blood pressure may occur due to peripheral vasodilatation. Increasing infusion rate will correct this.
- E. Should not be added to sodium bicarbonate or other alkaline solutions since dopamine will be inactivated at higher pH.

**Administration**

- A. Recommended Mix – 400 mg (2 ampules) in 250 ml NS or D5W (or use premixed) to produce concentration of 1600 mcg/ml.
- B. **Adult** – IV infusion ONLY. Start at 5 mcg/kg/min. Increase by 5 mcg/kg/min every 2–3 minutes to a level of 10–20 mcg/kg/min to achieve desired effect. Microdrip chamber only.
- C. **Pediatric** – Not appropriate for prehospital use.

**Side effects and special notes**

- A. Most common side effects include ectopic beats, nausea and vomiting. Angina has also been reported following treatment. Tachycardia and dysrhythmias occur but are less likely than with older pressor agents.
- B. Dopamine "whips" the heart and increases oxygen consumption, although to a lesser extent than other catecholamines. It should be reserved for patients with serious symptomatic hypotension NOT caused by hypovolemia.
- C. Tissue extravasation at the IV site can cause skin sloughing due to vasoconstriction. Be sure to make emergency department personnel aware if there has been any extravasation so proper treatment can be instituted.
- D. Can cause hypertensive crisis.
- E. Certain antidepressants potentiate the effects of this drug. Check for medications and contact base if other medications are being used.
- F. Not indicated for patients with atrial fibrillation.

**Table 7.1 INTRAVENOUS DRIP RATES FOR DOPAMINE**

Concentration – 1600 mcg/ml.					
Drip Rate – microdrips/min					
Dose (mcg/kg/min)					
Weight (kg)	5	10	15	20	Microdrips Per min
50	10	20	30	40	
60	10	25	35	45	
70	15	25	40	50	
80	15	30	45	60	
90	15	35	50	70	
100	20	35	55	75	
110	20	40	60	85	

Drip rates in table do not yield exact mcg/kg/min, but are very close and are useful for field application.

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## **EPINEPHRINE**

### **Pharmacology and actions**

- A. Catecholamine with alpha ( $\alpha$ ) and beta ( $\beta$ ) effects.
- B. In general, the following cardiovascular responses can be expected
  - 1. Increased heart rate.
  - 2. Increased myocardial contractile force.
  - 3. Increased systemic vascular resistance.
  - 4. Increased arterial blood pressure.
  - 5. Increased myocardial O<sub>2</sub> consumption.
  - 6. Increased automaticity of the heart.
- C. Potent bronchodilatation.
- D. Pupillary dilatation.

The primary effect of epinephrine in cardiac arrest is peripheral vasoconstriction, which leads to improved coronary and cerebral perfusion pressure. It seems to produce beneficial redistribution of blood from peripheral to central circulation during CPR. It may make ventricular fibrillation more responsive to countershock.

### **Indications**

- A. Ventricular fibrillation or pulseless ventricular tachycardia, unresponsive to initial countershocks.
- B. Asystole.
- C. Pulseless Electrical Activity (PEA).
- D. Bradycardia with signs of shock.
- E. Systemic allergic reactions or anaphylaxis.
- F. Asthma.

### **Precautions**

- A. Should not be added directly to bicarbonate infusion.
- B. When used for allergic reactions, increased cardiac work can precipitate angina or MI in susceptible individuals.
- C. Due to peripheral vasoconstriction, should be used with caution in patients with poor peripheral circulation.
- D. Wheezing in an elderly person is more often due to pulmonary edema (pulmonary embolus also possible cause). Epinephrine is not indicated for pulmonary edema.
- E. Because epinephrine is a non-selective  $\beta$  drug, it exerts considerable stimulation effect on the heart. In asthma, particularly in older patients with heart disease, this may be detrimental.

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## **Administration**

### **Adult**

- A. Cardiac arrest – 1.0 mg (10 ml of 1:10,000 solution) IV initially, then 1.0 mg IV every 3–5 minutes thereafter. Flush each IV dose with 20 ml fluid.
- B. Anaphylactic shock, laryngeal edema – 1 ml of 1:10,000 SLOW IV or epinephrine drip.
- C. Generalized allergic reaction (with adequate perfusion) – 0.3 mg (0.3 ml of 1:1,000 solution) SQ or IM.
- D. Asthma – 0.3 mg (0.3 ml of 1:1,000 solution) SQ or IM. In patients over 40 years of age, use only for severe respiratory distress.
- E. By Direct Physician Order. – Epinephrine drip 1 to 4 mg in 250 NS or D5W, to enhance adrenergic tone start at 1 mcg/min, titrate to effect.

### **Pediatric**

- A. Cardiac arrest – 0.01 mg/kg (0.1 ml/kg of 1:10,000) IV. Repeat IV dose at 0.1 – 0.2 ml/kg every 3–5 minutes during the arrest. Flush each IV dose with 5–10 ml fluid bolus.
- B. Generalized allergic reaction (with adequate perfusion) – 0.01 mg/kg (0.01 ml/kg of 1:1,000 solution) SQ or IM.
- C. Asthma – 0.01 mg/kg (0.01 ml/kg of 1:1,000) SQ or IM.
- D. Bradycardia associated with signs of shock and unresponsive to airway improvement – 0.01 mg/kg (0.1 ml/kg of 1:10,000) IV – d

### **Side effects and special notes**

- A. Anxiety, tremor, palpitations, and headache are common side effects.
- B. Relatively contraindicated in patients with hypertension, hyperthyroidism, angina, or cerebrovascular insufficiency.
- C. Epinephrine is one prehospital drug that comes in two different strengths. The doses in milligrams are the same, but the volume of solution is different. Errors can be very dangerous (by a factor of 10).
- D. Epinephrine is extremely potent when given IV. It is easy to become cavalier since we commonly treat the cardiac arrest patient with "mega-dose" epinephrine. The effects on a live person with an intact cardiovascular system (even compromised by anaphylaxis) are significantly different. Epinephrine should be given IV in a live adult patient only in 1 ml (1:10,000) increments (0.1 mg) to prevent excess hypertension and dysrhythmias.
- E. Basic prehospital care personnel may administer or assist with administration of an Epi-pen.

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## **ETOMIDATE**

### **Pharmacology and actions**

Etomidate is a hypnotic drug without analgesic activity. Duration of hypnosis is brief, usually three to five minutes. Etomidate is associated with approximately 20% reduction in cerebral blood flow. Therefore, intracranial and intraocular pressures may be reduced with the use of etomidate. Etomidate is primarily metabolized in the liver and excreted in the kidney.

### **Indications**

As a hypnotic agent in conjunction with the use of a paralytic agent to facilitate rapid sequence intubation (RSI) and for sedation in the unstable tachydysrhythmia patient requiring cardioversion.

### **Precautions**

- A. Do not administer unless the solution is clear and the container undamaged.
- B. Etomidate is classified as Pregnancy Category C. No adequate controlled studies have been performed utilizing etomidate on pregnant women. Etomidate should be used in pregnancy only if the benefit outweighs risk.
- C. According to the package insert there are inadequate data for the use of etomidate in pediatric patients. However, a number of studies have subsequently shown no difference in response or complications in pediatric patients compared with adults.
- D. Known allergy or hypersensitivity to etomidate.

### **Administration**

- A. A patent IV or IO line must be established. No other route of administration is permitted.
- B. Administer 0.2 mg/kg of etomidate to all patients undergoing RSI or electrical cardioversion in the unstable patient, unless known severe hypersensitivity to etomidate exists – or if clinical condition is so critical, a “crash” intubation is indicated, excluding etomidate.
- C. Etomidate should be administered as a bolus and pushed over a one minute period of time. Administration times of one minute or more will decrease the likelihood of myoclonic activity.
- D. Etomidate should be given after lidocaine and atropine (if needed) and just before administration of succinylcholine.

### **Side Effects and Special Notes**

- A. Etomidate will not lower blood pressure or raise or lower heart rate if administration is carried out as described above. Therefore, etomidate is safe to use in the hypotensive patient. Typically etomidate has no effect on respiratory drive or the gag reflex. These attributes make etomidate more attractive in certain populations than the benzodiazepine drug class.

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- B. The onset of action for etomidate is between fifteen to sixty seconds. However, duration averages about five minutes. Therefore, in the RSI patient, it is likely that another sedative will need to be employed if intubation is confirmed successful and continued paralysis is maintained. Currently, diazepam or fentanyl will be employed as the adjunctive sedative in RSI cases after etomidate has worn off. Intubated patients, therefore, must be screened to ensure that they meet the required hemodynamic stability criteria before one of these sedatives are administered.
- C. Transient pain on injection at the site of the IV catheter has been reported.
- D. Transient skeletal muscle movements or contractions will be noted in about 30% of patients receiving etomidate. These movements are not seizures. They are myoclonic movements and may involve either unilateral or bilateral muscle groups. There may be an increased incidence in these muscle contractions when the drug is pushed very rapidly. Therefore, etomidate should be administered over a one minute period.
- E. Although, typically etomidate does not cause respiratory depression, hypoventilation or hyperventilation, on rare occasions all of these effects have been reported with this agent. Therefore, the paramedic must be vigilant for any change in respirations after administration of etomidate.
- F. Etomidate has been associated with nausea and vomiting in patients after the drug has worn off. In the intubated patient, this concern should not be much of an issue – since the airway is protected from aspiration. However, if the patient is not able to be intubated, post etomidate vomiting may place the patient at risk for aspiration. Paramedics should watch carefully for the onset of vomiting in the non-intubated RSI patient and be prepared to protect the patient from aspiration.
- G. Although extremely rare, known or suspected history of hypersensitivity to etomidate will be an absolute contraindication to the use of this drug.
- H. Etomidate may be given only once per patient in the EMS setting. Therefore, if the drug appears to be ineffective after one dose, clinical judgment must be employed as to what to do next. In the RSI patient, this may mean proceeding directly to succinylcholine if a case for “crash intubation” may be made.

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## **FENTANYL (SUBLIMAZE)**

### **Pharmacology and actions**

Sublimaze is a potent, synthetic–opioid analgesic agent, which is approximately 100 times more potent than morphine. It rapidly crosses the blood–brain barrier and tends to produce analgesia within 90 seconds. The clinical benefit of Sublimaze stems from its rapid onset, short duration (30–60 minutes), and minimal histamine activation. Since it binds to opiate receptors, in the same manner as morphine, to produce analgesia, it is reversible with naloxone. It also produces CNS and respiratory depression and must be utilized with caution in those patients who are prone to hypoxia and/or hypoventilation. Due to the minimal histamine release associated with this medication, it is beneficial as an analgesic agent in the face of bronchospastic lung disease and demonstrates minimal cardiovascular and hemodynamic side effects. It does not replace morphine as the analgesic of choice for myocardial pain or as an adjunct to the treatment of CHF patients.

### **Indications**

- A. The primary use of Sublimaze shall be as an analgesic for moderate to severe pain, including cardiac related chest pain.
- B. Also as an adjunctive sedative/hypnotic agent given to RSI patients that have been given vecuronium after a confirmed tracheal–located endotracheal tube.

### **Precautions**

- A. Use caution when administering Sublimaze to patients who suffer from hepatic and/or renal impairment, because drug accumulation/prolonged duration of action may occur.
- B. Muscular rigidity (“Wooden Chest Syndrome”) may occur which prevents adequate chest wall excursion and subsequently results in hypoventilation. This syndrome usually only occurs at higher dosage levels or with rapid administration and is reversible with naloxone. However, constant cardiovascular and pulmonary monitoring is warranted to prevent episodes of hypoxia.
- C. Not recommended for patients currently taking MAO inhibitors since the effects of this combination of medications may be unpredictable.
- D. Do not use in patients suffering from severe hemorrhage, shock, or hemodynamic instability.

### **Administration**

- A. Restricted to IV administration, unless a direct physician order is received for IM administration.
- B. Patients over 2 years of age shall be given 0.5-1.0 mcg/kg in over the course of 1-2 minutes (do not exceed 1.0 mcg/kg without physician order). This may be repeated one time after 10 –20 minutes, titrated to CNS, hemodynamic, and respiratory effects. Additional doses will require direct physician contact.

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- C. When given in the RSI Protocol, the dosage for adult and pediatric patients is 1.0 mcg/kg. fentanyl must only be given to the RSI patient via the IV or IO routes. IM administration is not permitted in the RSI patient. Paramedics should assess the hemodynamic stability of the RSI patient prior to administration of fentanyl – as discussed in the RSI Protocol.

**Side effects and special notes**

- A. Respiratory depression and apnea may result with the administration of this medication. A high level of attentiveness to the patient's respiratory status and prevention of hypoventilation/hypoxia are required. ***Be prepared to intervene!***
- B. Bradycardia is a rare side effect of Sublimaze administration at these dosages. Treat bradycardia with Atropine only after ensuring adequate ventilation and oxygenation.
- C. Other CNS depressant medications or substances may have additive or potentiating effects.

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## **FUROSEMIDE (LASIX)**

### **Pharmacology and actions**

Furosemide is a potent diuretic with a rapid onset of action and short duration of effect. It acts primarily by inhibiting sodium re-absorption throughout the kidney. Increase in potassium excretion occurs along with the sodium excretion. As an IV bolus, it causes immediate (3–4 minutes) increase in venous capacitance. This decreases venous back-up and probably accounts for an immediate effect in pulmonary edema. Peak effect is 1/2 – 1 hour after IV administration; duration about 2 hours. Duration 6–8 hours if given orally, with a peak in 1–2 hours. Tolerance develops and larger doses may be needed in patients with renal failure or those chronically taking furosemide.

### **Indications**

- A. Acute pulmonary edema – to decrease extracellular volume and reduce venous pressure in the lungs in cardiac failure.
- B. Massive head trauma – used in some regions to treat traumatic cerebral edema and lower intracranial pressure.

### **Precautions**

- A. Do not use in presence of hypotension or other signs of hypovolemia. Can lead to profound diuresis with shock and electrolyte depletion.
- B. Have urinal available. Effect may be seen within 10–15 minutes.
- C. Foley catheter insertion should be considered during long transports (over 30 minutes) or before transferring a head-injured patient receiving diuretics, in order to prevent bladder injury or incontinence.

### **Administration**

- A. **Adult dose** – 40 mg slowly IV (over 2 minutes).
- B. **Pediatric dose** – 1 mg/kg.

### **Side effects and special notes**

- A. Because of potency and need for close monitoring, should only be used in the field in seriously ill patients who require immediate intervention.
- B. Dose of furosemide may need to be increased in patients chronically on furosemide. Check with base if you think larger dose indicated.
- C. May cause acute and profound diarrhea.
- D. Hypokalemia, hyponatremia, and hypovolemia are the main toxic effects. The hypokalemia is of particular concern in digitalized patients, and especially in digitalis-toxic patients.

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## **GLUCAGON**

### **Pharmacology and actions**

Glucagon is a hormone which causes glucose mobilization in the body. It works opposite to insulin, which causes glucose storage, and it is normally secreted in the pancreas. Glucagon is released at times of insult or injury when glucose is needed. It stimulates the synthesis of cyclic AMP and its metabolic effects are similar to epinephrine. In the hypoglycemic patient, return to consciousness will be about 20 minutes after IM dose.

### **Indications**

- A. Hypoglycemia or insulin shock in patients who are unconscious (unable to take oral solutions) and in whom venous access cannot be obtained.
- B. Hypoglycemia in combative, uncontrollable patient in whom IV dextrose cannot be administered and transport time is over 20 minutes.
- C. To increase myocardial contractility in patients with critically symptomatic Beta blocker or calcium channel blocker overdose.
- D. For management of esophageal spasm.

### **Precautions**

- A. Patients with no liver glycogen stores (due to alcoholism, malnutrition) may not be able to mobilize any glucose in response to glucagon and the treatment will be ineffective.
- B. Hyperglycemic effect of glucagon is of short duration (1–2 hour) so the patient must be transported and fed to replenish glucose stores and prevent recurrence of the hypoglycemia.

### **Administration**

- A. **Adults** – Hypoglycemia – 1.0 mg IM or SQ.  
Beta blocker or calcium channel blocker overdose – 2–4 mg IV. (MUST BE DILUTED WITH D5W or NS FOR THIS PURPOSE, NOT A DILUENT WHICH CONTAINS PHENOL)
- B. Children under 12 years – 0.5 mg IM or SQ.

### **Side effects and special notes**

- A. Nausea and vomiting may occur.
- B. IV glucose or dextrose is the treatment of choice for insulin shock. Use of glucagon is restricted to patients as described above in whom IV access is impossible. In these rare situations, it can be very useful.

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## **HALDOL (HALOPERIDOL)**

### **Pharmacology and actions**

Haloperidol is a butyrophenone major tranquilizing agent. It probably exerts its antipsychotic effect by blocking post-synaptic CNS dopamine receptors. In addition, haloperidol also causes alpha-adrenergic blockade and has weak anticholinergic and antiemetic effects. Haloperidol may cause sedation and tends to have a high incidence of extrapyramidal side effects. Intramuscular doses are approximately 70% absorbed within 30 minutes. Haloperidol is metabolized through the liver and primarily excreted through the kidneys.

### **Indications**

- A. Acute psychotic disorders.
- B. Severe combativeness that cannot be controlled by reasonable means.

### **Precautions**

- A. Contraindicated in patients with Parkinsonism.
- B. May lower seizure thresholds
- C. Do not use in patients with history of neuroleptic malignant syndrome.
- D. May cause severe neurologic injury in patients taking lithium.

### **Administration**

- A. Patients >12 yrs: Administer 5.0 mg deep **IM**.

### **Side effects and special notes**

- A. Sedation, hypotension, dizziness, severe extrapyramidal symptoms, neuroleptic malignant syndrome, and seizures are among the most concerning with acute administration.
- B. May cause anticholinergic-type symptoms.
- C. Treat extrapyramidal symptoms with diphenhydramine.
- D. May cause prolongation of QT interval. Place patient on cardiac monitor at first opportunity.

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## **HEPATITIS B VACCINE (RECOMBINANT)**

### **Pharmacology and actions**

The vaccines currently in use in the United States are made with recombinant DNA technology, and contain protein portions of HBV (usually parts of the outer protein or the surface antigen of HBV). Thus, the vaccines do not contain any live virus. More than 95% of children and adolescents and more than 90% of young, healthy adults develop adequate immunity following the recommended three doses. Persons who respond to the vaccine are protected from both acute hepatitis B infections as well as chronic infection.

### **Indications**

- A. Pre–employment/employment related.

### **Precautions**

- B. A serious allergic reaction to a prior dose of hepatitis B vaccine or a vaccine component is a contraindication to further doses of hepatitis B vaccine.
- C. Persons allergic to yeast should not be vaccinated with vaccines containing yeast.
- D. Paramedics should not administer the Hepatitis B vaccine to anyone under the age of 18.

### **Administration**

- A. 1.0 ml IM (Adult). The Deltoid muscle is the preferred site.
- B. Three doses will be required.
  - 1. 1st dose: elected date
  - 2. 2nd dose: 1 month later
  - 3. 3rd dose: 6 months from 1st dose.

### **Side effects and special notes**

- A. Pain in area of injection site, mild fever, and chills may occur.
- B. In rare cases a severe allergic reaction may occur. If so, follow the Allergy/Anaphylaxis protocol.
- C. Administered doses should be documented on a vaccination record and provided to the recipient as well as maintained in agency records. Documentation should include the manufacturer, lot number, expiration date, dose given, and site of injection. Recipient should read an information sheet and sign an authorization and consent form before administration.
- D. Vaccine should be refrigerated at 36–40 degrees F.

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## **INFLUENZA VIRUS VACCINE**

### **Pharmacology and actions**

Influenza Virus Vaccine is an inoculation of antigens prepared from inactivated influenza virus stimulating the production of specific antibodies. Protection is afforded only against those strains from which the vaccine is prepared or against closely related strains.

### **Indications**

For the production of immunity to influenza virus

- A. Any person who, because of age or underlying medical condition, is at increased risk for complications of influenza.
- B. Healthcare workers and others (including household members) in close contact with high-risk persons.
- C. Persons who wish to reduce their risk of acquiring influenza.

### **Precautions**

- A. Paramedics may not administer vaccine to anyone under the age of 8 years. Persons 8–12 years of age must have had the vaccine previously.
- B. Contraindicated in persons with previous hypersensitivity to any component of the vaccine or allergy to eggs or egg products.
- C. Pregnant women must have a note from their Obstetrician.
- D. Do not administer influenza vaccine within 3 days of pertussis vaccine or combined diphtheria/tetanus/pertussis (DPT) vaccine.

### **Administration**

Age 8 years or older: 0.5 ml IM. Only one dose is required.

### **Side effects and special notes**

- A. Pain in arm at the injection site, fever, chills, headache, muscle aches may occur.
- B. In the event of a presumed allergic reaction such as hives, angioedema, allergic asthma, or systemic anaphylaxis:
  - 1. Activate EMS system.
  - 2. Administer Benadryl 50 mg PO
  - 3. If reaction severe and patient less than 50 years of age, administer epinephrine 1:1000, 0.3 ml S.C.
  - 4. Continue per Allergy/Anaphylaxis protocol.

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## **IPRATROPIUM BROMIDE (ATROVENT)**

### **Pharmacology and actions**

Ipratropium bromide is an anticholinergic agent which inhibits interaction of acetylcholine at parasympathetic receptor sites on the bronchial smooth muscle. Absorption of ipratropium is minimal following inhalation; thus, significant systemic effects are rare. Most frequent clinical effects include

- A. Bronchial dilatation, with improvement in FEV1 and peak flow rate within 3 minutes. 80% of maximal response is seen within 30 minutes.
- B. Dryness of mouth with bitter taste.

### **Indications**

Ipratropium is indicated as an adjunct bronchodilator for asthma, chronic bronchitis, and emphysema which are not being adequately controlled by beta adrenergic agents such as albuterol.

### **Precautions**

- A. Not to be used as primary therapy for bronchospasm. Must be used with albuterol in nebulizer.
- B. Frequently causes nasal dryness – be prepared to manage epistaxis.
- C. Use with caution in patients who have a history of acute narrow-angle glaucoma, prostatic hypertrophy, and bladder-neck obstruction.
- D. Contraindicated in children under 12 years old.
- E. Contraindicated in patients with hypersensitivity to atropine or its derivatives, soya lecithin, soybean, or peanuts.

### **Administration**

- A. Nebulizer solution – Available as 250 mcg/ml solution in 20 ml multi-dose or 2 ml unit dose vials.  
Metered dose inhaler – Available as 18 and 20 mcg/ actuation in 10 ml canisters
- B. Adults – administer by nebulizer –0.5 mg (2 ml) with 1 unit dose (2.5 mg/3 ml) of albuterol. If available in MDI, administer 2 puffs.
- C. Administer with second dose of albuterol that patient receives.
- D. Repeat doses are recommended every 6 hours; thus, are not applicable in most transport situations.

### **Side effects and special notes**

- A. Mouth dryness, bitter taste, nausea, and epistaxis.
- B. Side effects may include nausea, vomiting, muscle cramps, blurred vision, anxiety, dizziness, headache, and palpitations.
- C. Concomitant use of tetrahydrocannabinol (THC) and anticholinergic agents such as ipratropium may increase the heart rate beyond that expected with either drug alone. Avoid the use of ipratropium in patients who are under the influence of THC, particularly if unable to tolerate tachycardia.
- D. Basic prehospital care providers may be asked to assist with administration of the patient's inhaler. Contact base physician.

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## IV SOLUTIONS

### Pharmacology and actions

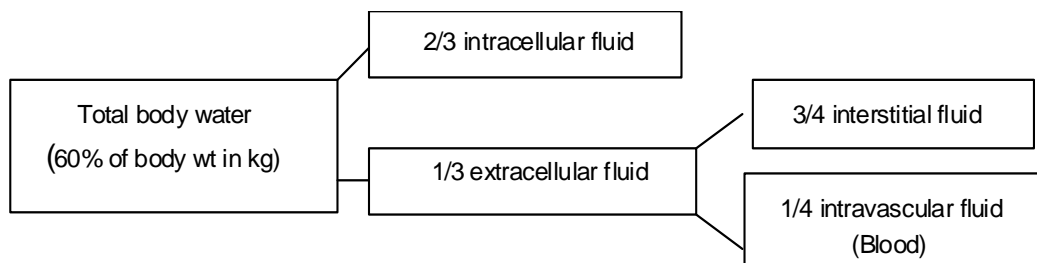
Two types of solutions are available for use in the field.

A. Volume expanders (Ringer's lactate or normal saline)

These contain sodium as the major cation and expand the extracellular fluid space. RL is the same tonicity (concentration of electrolytes) as body fluids. NS is actually slightly hypertonic.

B. Water solution (D5W)

This diffuses through three times the body space of NS and RL. It is therefore, inefficient as a volume expander. Dextrose contained in the solution makes it isotonic to body cells and prevents solution from damaging cells. The dextrose is rapidly metabolized and produces little energy for the body to use (200 cal/L). The net effect is addition of water to the patient.



When replacing fluids

**Blood** – stays in intravascular space.

**Volume expander** (RL or NS) – diffuses through extracellular volume (1/4 stays intravascular).

**Water** (D5W) – diffuses through total body water (1/12 stays intravascular).

### Indications

- A. Volume expanders – to expand intravascular volume in the present of hemorrhagic shock, volume depletion (dehydration, burns, severe vomiting), or shock caused by increased vascular space (neurogenic shock).
- B. Water solutions – to obtain intravenous access to a patient.
1. To treat with IV medications.
  2. To assure later access for treatment in patients with potentially unstable conditions.

### Precautions

- A. In hemorrhagic shock, volume expansion with BLOOD is the treatment of choice. Crystalloid solutions (RL or NS) will temporarily expand intravascular volume and "buy time," but do not increase oxygen-carrying capacity, and are insufficient in severe shock. Because of this, rapid transport is still necessary to treat severely hypovolemic patients who need blood and possibly surgical intervention to stop ongoing bleeding.

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- B. Volume overload is a constant danger, particularly in cardiac patients. Keep a close eye on your IV rate during transport. Mysterious excess fluid boluses are all too common. Consider saline lock if fluid is not required.

**Administration**

- A. Through peripheral vein by needle or cannula.
- B. TKO/KVO = 20–40 microdrips/min = 5–10 drops/min.
- C. For administration of fluid bolus – 20 ml/kg volume expander through large bore cannula, as rapidly as possible.
- D. 1 ml/min = 60 microdrops/min = 10–20 macrodrops/min (depending on administration set).
- E. Needle or cannula size
1. 25 gauge = smaller
  2. 14 gauge = larger
- For administration of volume expanders (RL or NS) – largest diameter possible (14 gauge preferred)
- For administration of water solutions – size not as important; aim for security and accuracy. Larger bore can occasionally be useful.

**Side effects and special notes**

- A. TKO rate should always be used for water solutions AND for volume
- B. expanders in a stable patient. Without excess fluids, you will know that your patient is stable and not being "helped" by fluids. Give wide open bolus as above if fluids are needed.
- C. In trauma patients, 14 g cannulas should be used most frequently. Flow
- D. rate through a 14 g cannula is twice the rate through an 18 g cannula, and volume administration in trauma patients can be accomplished more rapidly. The larger cannula is more painful to insert, but with practice can be placed reliably. If the patient has poor veins, a smaller bore is better than no IV at all in most instances.
- E. IVs in an unstable trauma patient should be placed enroute, and may be left to the hospital setting for short transports. Do not delay transport for IV attempts.
- F. Two attempts are the limit per person. If you are unable to start in two attempts, another qualified attendant may try, or leave the IVs for the hospital. Some patients are very difficult and some days are more difficult too!
- G. IV fluid bolus for the trauma patient in shock is increasingly controversial. Recent data question the wisdom of pouring fluids into a patient who has ongoing blood loss internally. Patients at risk for internal hemorrhage should have two large bore lines. By system consensus volume expander may be used to maintain a systolic blood pressure of 90–100 mm Hg, until the patient is in the hospital (ED or OR) where internal bleeding can be controlled. Do Not exceed 40 ml/kg of total IV fluid. After bleeding is controlled, those lines may prove invaluable for infusing fluids and blood.

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## **LIDOCAINE (XYLOCAINE)**

### **Pharmacology and actions**

- A. Depresses automaticity of Purkinje fibers; therefore, raises stimulation threshold in the ventricular muscle fibers (makes ventricles less likely to fibrillate).
- B. Little antidysrhythmic effect on atrial muscle at subtoxic levels.
- C. May suppress cough reflex at therapeutic levels. This will result in decreased intracerebral pressure response to intubation and make the aware patient more comfortable while the endotracheal tube is in place.
- D. CNS stimulation: tremor, restlessness and clonic convulsions, followed by depression and respiratory failure at higher doses.
- E. Cardiovascular effects: decreased conduction rate and force of contraction, mainly at toxic levels.
- F. The effect of a single bolus on the heart disappears in 10–20 minutes due to redistribution in the body. Metabolic half-life is about 2 hours; therefore, toxicity develops with repeated doses.

### **Indications**

- A. Significant PVCs in suspected myocardial infarction or contusion when
  1. PVCs more than 6/minute.
  2. Close coupled PVCs (R on T).
  3. Multifocal PVCs.
  4. Runs of 2 or more PVCs in a row.
- B. Ventricular tachycardia or wide-complex tachycardia with pulses.
- C. Recurrent or refractory ventricular fibrillation.
- D. Following successful defibrillation in patients prone to recurrent ventricular fibrillation.
- E. Prior to intubation in patients suspected of having increased intracranial pressure.
- F. Prior to intubation in patients at risk for vagal mediated cardiac dysrhythmias.
- G. May be used to control the cough reflex and associated irritation of the trachea associated with intubation.
- H. For intraosseous anesthetization.

### **Precautions**

- A. Use with extreme caution in presence of advanced A–V block unless artificial pacemaker is in place.
- B. Atrial fibrillation or flutter, quinidine-like effect may cause alarming ventricular acceleration.
- C. Lidocaine is not for treatment of supraventricular rhythms.
- D. Diazepam should be available to treat convulsions if they occur.
- E. Do not treat ventricular escape beats with lidocaine. In severe block, these may be providing patient perfusion.
- F. Do not delay intubation efforts to start an IV or administer medication when the primary need is AIRWAY.

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- G. Anaesthetization of the airway structures may present problems associated with aspiration if the patient is extubated before the effects of the lidocaine have worn off. Maintain the integrity of the airway and ensure that the receiving facility is aware of this danger.

### **Administration**

#### INTERMITTENT IV BOLUS METHOD – for cardiac arrest

- A. **Adult** – 1.0 – 1.5 mg/kg IV bolus.  
**Pediatric** – 1 mg/kg IV bolus
- B. Second bolus of 0.5–0.75 mg/kg IV after 5 min for persistent VF.
- C. Third bolus of 0.5–0.75 mg/kg given after another 5 min during long transports with persistent VF. Max 3 mg/kg by bolus only.

#### IV BOLUS AND DRIP METHOD – to treat significant PVCs in patient with good circulation

- A. 1 mg/kg slow IV bolus, adult and pediatric.
- B. 2nd bolus of 0.5–0.75 mg/kg IV is given 5 minutes after 1st bolus in addition to drip. Max 3 mg/kg by repeat bolus.
- C. IV drip – Mix 1 gm lidocaine in 250 ml NS or D5W for a concentration of 4 mg/ml (or use premixed drip solution, 2 gm lidocaine in 250 ml for concentration of 8 mg/ml). Run 2–4 mg/min (20–40 mcg/kg/min) or 30–60 microdrops/min. Must be started soon after first bolus or blood levels will rapidly disappear.

#### SINGLE IV BOLUS DOSING – for intubation.

Single IV dose (1.5 mg/kg) if time available in patient who needs intubation and has potential for increased intracranial pressure. Administer at least 60 seconds before intubation.

#### ENDOTRACHEAL ROUTE DOSING

- A. Cardiac Arrest – 2–3 mg/kg ET with 10 ml total volume.
- B. Tracheal Irritation – 1.5 mg/kg ET.

NOTE – Bolus (to 3 mg/kg) may be administered through endotracheal tube.

### **Side effects**

- A. CNS disturbances – sleepiness, dizziness, disorientation, confusion, muscular twitching, focal or grand mal seizures.
- B. Hypotension – increased A–V block and decreased myocardial contractility at toxic levels only.
- C. Rare instances of sudden cardiovascular collapse and death.
- D. Toxicity increased in elderly patients and those with liver impairment.

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**Special notes**

- A. Lidocaine is metabolized in the liver and elderly patients and patients with hepatic disease, shock or congestive heart failure will not break down the drug rapidly. Administer 1.0 mg/kg and reduce the drip by one-half. Second bolus usually not indicated.
- B. A bolus of lidocaine will establish a given level of drug in the blood. The drip maintains this level by replacing metabolized drug. It should, therefore, be started rapidly. Without a bolus, a drip has no effect for 30–60 minutes. The second bolus is given to prevent an observed dip in blood level which occurs 20 minutes after initial bolus and drip.
- C. Lidocaine is another drug which comes in different concentrations
  - 1. *Prefilled Syringes* – 50–100 mg in 5–10 ml for bolus administration (1% solution).
  - 2. *Vials* – 500–1000 mg in 5–10 ml solution for IV drips (10% solution).
  - 3. *Premixed drip solution* – 2 Gm in 250 ml NS OR D5W for concentration of 8 mg/ml.
- D. The desire to treat all PVCs is a disease called the "lidocaine itch." It is commonly found in field and hospital personnel. PVCs should be treated only when significant and premature ventricular beats are encountered in the setting of acute angina or MI. PVCs generated by hypoxia will not respond to lidocaine and the wrong life–threat will be treated.
- E. Prophylactic lidocaine in the patient with cardiac type chest pain is no longer recommended. The patient with chest pain who is also having frequent or multifocal PVCs, however, should have lidocaine administered to treat PVCs. This is not the same as prophylactic use (giving the drug before it is needed to prevent it being needed). Do not hesitate to treat dangerous PVCs in the patient with suspected cardiac chest pain.
- F. An endotracheal tube is quite distressing and uncomfortable in the patient with some degree of awareness. “Bucking the tube” is common. Local anesthetic (lidocaine down the tube for tracheal irritation and benzocaine topically for pharyngeal stimulation) and IV pain control and/or sedation are clearly humane and recommended when it is preferred for the patient to remain intubated.

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## **LIDOCAINE VISCOUS**

### **Pharmacology and actions**

As a local anesthetic, lidocaine acts to block initiation and conduction of nerve impulses by decreasing the permeability of the nerve cell membrane to sodium ions.

### **Indications**

Local anesthesia of skin or mucous membranes – Use as a lubricant and local anesthetic for procedures such as nasopharyngeal airways, nasotracheal intubation, orotracheal intubation, or insertion of foley catheters.

### **Administration**

- A. Viscous lidocaine comes as a 2% solution (20 mg/ml).
- B. Lubricate tube liberally prior to insertion.
- C. Insert tube as specified by type (NPA, ETT, etc).
- D. Onset of action occurs in 3–5 minutes.

### **Precautions**

- A. Do not use in patients with a hypersensitivity to amide–type local anesthetics.
- B. Monitor patient for any type of allergic reaction after use of viscous lidocaine.
- C. When viscous lidocaine is used concomitantly with other products containing Lidocaine, the total dose contributed by all formulations must be kept in mind.

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## **MAGNESIUM SULFATE**

### **Pharmacology and actions**

Magnesium is a cofactor for many enzymatic reactions. It is essential for the function of the sodium–potassium ATPase pump. Magnesium prevents or controls convulsions by blocking neuromuscular transmissions. Magnesium has a depressant effect on the CNS. It acts as a physiological calcium channel blocker and may also produce heart block. Magnesium may reduce the incidence of post infarction ventricular dysrhythmias.

### **Indications**

- A. Pregnant patients (usually greater than 20 weeks) with preeclampsia.
  - 1. Blood pressure greater than 180 systolic or 120 diastolic.
  - 2. Altered mental status.
  - 3. Generalized or severe localized edema.
  - 4. Headache and/or visual disturbance.
- B. Pregnant patients (usually greater than 20 weeks) with eclampsia – any of the above signs AND seizures.
- C. Polymorphic V tach or suspected hypomagnesemic states.
- D. May be useful for the treatment of asthma which is severe and not responding promptly to albuterol.

### **Precautions**

- A. May occasionally lead to A–V blocks or respiratory arrest. Calcium chloride may reverse respiratory and cardiac effects. Calcium should be readily available before administration of magnesium sulfate.
- B. Not indicated in patients with heart block or significant cardiac disease. (Use caution if patient is taking digitalis.)

### **Administration**

Administer 1–2 Gm in 50 ml NS OR D5W to run in over 5–10 minutes (IV push in cardiac arrest only).

### **Side effects and special notes**

- A. Principle complication is respiratory depression: Be prepared. Never administer as a bolus unless the patient is in cardiac arrest.
- B. May need to decrease dosage if patient is using other depressant drugs (e.g., barbiturates, narcotics, hypnotics). Effects may be additive and increase the risk of respiratory depression.

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## **METERED DOSE INHALERS (MDI)**

### **Pharmacology and actions**

Bronchodilator dilates bronchioles, reducing resistance in the airway thus improving oxygenation and making breathing easier.

The following are medications that may be encountered

Albuterol, Isoetharine, Metaproterenol, Proventil, Ventolin, Bronkosol, Bronkometer, Metaprel, Alupent

### **Indications**

- A. The patient exhibits signs of respiratory distress.
- B. The patient has an inhaler prescribed to the patient, by a physician.
- C. The prescribed inhaler has not expired.

### **Precautions**

Assisting the patient in the use of an inhaler is contraindicated if any of the following conditions exist.

- A. The patient is unconscious or otherwise unable to use the device.
- B. The inhaler is not prescribed for the patient, (someone else's inhaler).

### **Administration**

- A. The number of inhalations is based on a physician's prescribed dose
- B. Two MDI "puffs" are often prescribed PRN as a normal dose.
- C. When the Basic-EMT encounters a respiratory distress patient who has a prescribed inhaler, follow the steps below to assist the patient in its use.
  - 1. Administer oxygen and listen to breath sounds.
  - 2. Determine if the patient has taken any doses of the medication, if so, how many and when.
  - 3. Assure that the medication is the correct one (bronchodilator) and that it has been prescribed for the patient.
  - 4. Assure that the patient is able to use the device.
  - 5. Check the expiration date on the inhaler.
  - 6. Obtain authorization from base physician, to assist with administering the medication.
  - 7. Assure that the inhaler is at room temperature or warmer.
  - 8. Shake the inhaler vigorously for at least 30 seconds.
  - 9. Remove the oxygen delivery device from the patient (or turn it off momentarily).
  - 10. Have the patient hold the inhaler upright, exhale deeply and place lips around its opening. (If the patient is unable to hold the inhaler, hold it for them by placing your index finger on the top of the metal canister and your thumb on the bottom of the plastic canister).
  - 11. Instruct the patient to depress the inhaler while inhaling deeply or depress the inhaler for the patient while the patient inhales deeply. (Usually, two MDI "puffs" are prescribed as a normal dose).

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12. Coach the patient to hold their breath for as long as is comfortable so that the medication can be absorbed.
13. Replace the oxygen delivery device (or continue flow) on the patient after assisting with the MDI.
14. If medical direction authorizes a second dose of the medication, repeat steps 7–12 after the patient has taken several breaths.

**Side effects and special notes**

- A. Side effects may include increased heart rate, nervousness and tremors.
- B. It is important to determine how many doses, if any, of the medication that patient has already taken. Medical direction can then determine how much, if any, should be administered.
- C. Some types of inhalers contain medications other than bronchodilators. In general, EMT's should not assist with the use of these types of inhalers in the prehospital setting.
- D. Some inhalers are connected to a device called a "spacer" or "aerochamber." The spacer is a chamber into which the medication is delivered, before the patient inhales. The spacer prevents any loss of the medication to the outside air and permits more effective use of the medication. If the patient has a spacer with their inhaler, be sure to use it.
- E. Paramedics and intermediate EMT's should, if at all possible, utilize nebulized medications for delivery of bronchodilators to patients with breathing difficulty.

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## **MORPHINE SULFATE (MS)**

### **Pharmacology and actions**

- A. Analgesia.
- B. Pupil constriction.
- C. Respiration – decreased rate and tidal volume.
- D. Peripheral vasodilatation.
- E. Cardiac effect (reflex due to vasodilatation)
  - 1. Decreased myocardial oxygen consumption.
  - 2. Decreased left ventricular end–diastolic pressure.
  - 3. Decreased cardiac work
  - 4. May decrease incidence of dysrhythmias.
- F. Effect – maximum within 7 minutes IV.

### **Indications**

- A. Presumed cardiac chest pain or anginal equivalent.
- B. Treatment for pain.

### **Precautions**

- A. Hypotension is a relative contraindication to use of morphine. *Remember that some people will be hypotensive in response to pain itself.* Smaller doses are less likely to cause or aggravate hypotension.
- B. Do not use in persons with respiratory difficulties (except pulmonary edema) because their respiratory drive may become depressed.
- C. Do not use in the presence of major blood loss. The body's compensatory mechanisms will be suppressed by the use of morphine and the hypotensive effect will become very prominent.
- D. May cause vomiting. Administer slowly.

### **Administration**

- A. IV only (unless you cannot start an IV and are specifically directed to administer IM).
- B. **Adult** – 2–4 mg IV initially, repeat every 5 minutes if needed. Do not exceed 0.2 mg/kg. The goal is decreased anxiety and patient comfort. The patient need not be completely pain–free.

### **Side effects and special notes**

- A. The major side effects and complications from morphine result from vasodilatation. This causes no problems if the patient is supine and not volume depleted. It may cause problems if the patient is upright, hypovolemic, or has decreased cardiac output (after MI).

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- B. Allergic reactions are rare, but ask! If patient reports allergy to other narcotics – ask for the reaction. Codeine notoriously causes nausea, vomiting, or GI distress. These are not allergic reactions and should have no effect on your use of morphine. The patient who reports allergies to many narcotics and reports swelling of the airway, shock, or other significant responses, however, should not receive morphine.
- C. Be prepared to ventilate if the patient stops breathing. Naloxone can be used to reverse medication effects, but it leaves no good alternative for pain relief. Respiratory support may be a better alternative.

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## NALOXONE (NARCAN)

### Pharmacology and actions

Naloxone is a narcotic antagonist which competitively binds to narcotic sites but which exhibits almost no pharmacologic activity of its own. Duration of action is 1–4 hours.

### Indications

- A. Reversal of narcotic effects, particularly respiratory depression due to narcotic drugs either ingested, injected or administered in the course of treatment. Diagnostically in coma of unknown etiology to detect or reverse narcotic cardiorespiratory depression if present.
- B. Seizure of unknown etiology to reverse possible narcotic overdose (particularly propoxyphene).

### Precautions

- A. In patients who are addicted to narcotics, frank and occasionally violent withdrawal symptoms may be precipitated. Titrate the dose (0.2 ml at a time) to reverse cardiac and respiratory depression but keep the patient groggy. Be prepared to restrain the patient.
- B. Titration may also assist the patient who is taking narcotics for pain (patients with known cancer). Very small amounts over time can reverse the respiratory depression, but still leave the patient with some pain control.
- C. May need large doses (8–12 mg) to reverse propoxyphene (Darvon) overdose.

### Administration

- A. Supplied in various concentrations. Stock and use only one, if possible, to avoid confusion or drug errors.
  1. 1 ml ampule = 0.4 mg.
  2. 10 ml vial = 4.0 mg.
- B. **Adult** – 0.4 mg IV, repeat as needed.  
**Pediatric** – 0.04 mg/kg IV
- C. If no response is observed, this dose may be repeated after 5 minutes if narcotic overdose is strongly suspected.

### Side effects and special notes

- A. The duration of some narcotics is longer than naloxone. The patient must be monitored closely since repeated doses of naloxone may be necessary. Patients who have received this drug must be transported to the hospital since coma may recur as naloxone wears off.
- B. With an endotracheal tube in place and assisted ventilation, narcotic overdose patients may be safely managed without naloxone. Smaller doses of narcan can be used to assure adequate ventilaton. **Think twice before totally reversing coma. Airway control may be lost, or worse, the patient may become extremely violent.**

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## **NITROGLYCERIN**

### **Pharmacology and actions**

- A. Cardiovascular effects include
  1. Reduced venous tone, causing blood-pooling in peripheral veins and decreasing venous return to the heart.
  2. Decreased peripheral resistance.
  3. Dilatation of coronary arteries (if not already at maximum) and relief of coronary artery spasm.
- B. Generalized smooth muscle relaxation (including esophagus).

### **Indications**

- A. Angina or anginal equivalents.
- B. Chest, arm, or neck pain thought caused by coronary ischemia.
- C. Control of hypertension in angina or acute MI.
- D. Pulmonary edema – to increase venous pooling, lowering cardiac preload and afterload.

### **Precautions**

- A. Generalized vasodilatation may cause profound hypotension and reflex tachycardia.
- B. NTG loses potency easily. It should be stored in dark glass container with tight lid and not exposed to heat.
- C. Use with caution in hypotensive patients.
- D. Do Not Use Nitrates in patients who have taken Viagra (or other sexually enhancing drugs) in the last 12–36 hours.
- E. Nitrates may be associated with significant hypotension especially in patients with inferior wall and/or right ventricular myocardial infarction.

### **Administration**

- A. **Adult** – 0.4 mg (1/150) tablet or spray sublingually. May repeat every 5 minutes as needed for effect.
- B. **Pediatric** – Not indicated for use in children.

### **Side effects and special notes**

- A. Common side effects include throbbing headache, flushing, dizziness and burning under the tongue. These side effects may be used to check potency of medication.
- B. Less common – orthostatic hypotension, sometimes marked. Be prepared to lay patient flat and elevate legs if blood pressure drops.
- C. Therapeutic effect is enhanced but adverse effects are increased when patient is upright.
- D. Because nitroglycerin causes generalized smooth muscle relaxation, it may be effective in relieving chest pain caused by esophageal spasm.
- E. Basic prehospital care personnel may assist with administration of the patient's nitroglycerin after direction from base physician. EMT Intermediates may administer nitroglycerin sublingually under standing orders

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## **ONDANSETRON (ZOFRAN)**

### **Pharmacology and actions**

Ondansetron is a selective serotonin antagonist, which inhibits nausea and vomiting caused by the activation of chemoreceptors in the medullary structures of the brain and visceral stimuli in the small bowel. It has little to no effects on nausea and vomiting caused by the release of histamine and acetylcholine from vestibular causes.

### **Indications**

Non-vestibular causes of nausea and vomiting

### **Contraindications**

Sensitivity or allergy to serotonin antagonists

### **Administration**

- A. Adults and children over 40 kg: 4 mg IV over 2 minutes (may also be given IM)
- B. Children over 1 month of age and less than 40 kg: 0.1 mg/kg not to exceed 4 mg
- C. Adults and children over 11 years old: 8 mg ODT tablet
- D. Children 4 – 11 years old: 4 mg ODT

### **Side effects and special notes**

- A. Occasionally, there have been reported cases of transient prolongation of the QT interval
- B. Rare cases of seizure activity and extrapyramidal reactions have been reported

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## OXYGEN

### Pharmacology and actions

Oxygen added to the inspired air raises the amount of oxygen in the blood, and therefore, the amount delivered to the tissues. Tissue hypoxia causes cell damage and death. Breathing in most persons is regulated by small changes in acid/base balance and CO<sub>2</sub> levels. It takes relatively large drops in blood O<sub>2</sub> concentration to stimulate respiration.

### Indications

- A. Respiratory distress or suspected hypoxemia from any cause.
- B. Chest pain in which myocardial ischemia or infarction is suspected.
- C. Major Trauma or Shock (decreased oxygenation of tissues) from any cause.
- D. Any inhalation or noxious gas exposure.
- E. High altitude illness.

### Precautions

- A. If the patient is not breathing adequately on his own, the treatment should be ventilation, not just O<sub>2</sub>. A nasal cannula without a breath is a waste of O<sub>2</sub> (and patients)!
- B. A small percentage of patients with chronic lung disease breathe because they are hypoxic. Administration of O<sub>2</sub> may shut off their respiratory drive. **DO NOT WITHHOLD OXYGEN BECAUSE OF THIS POSSIBILITY. BE PREPARED TO ASSIST VENTILATION, IF NEEDED.** Initial O<sub>2</sub> flow should be 2 L/min or 1 L/min greater than home O<sub>2</sub> in these patients.
- C. If pulse oximetry is available, titrate oxygen saturation (SaO<sub>2</sub>) to 90% or greater. Be aware, however, that in some cases, the reading will be meaningless (CO poisoning) and oxygen flow should be at a maximum (10–15 L/min). In patients with COPD, pulse oximetry may not reach 90% even with high flow, non-rebreather mask.

### Administration

Dosage	Indications
Low flow (1–2 L/min)	Patients with chronic lung disease.
Moderate flow (4–6 L/min)	Minimal respiratory difficulty. Trauma. Abdominal Pain.
High flow (10–15 L/min)	Severe breathing difficulty. Carbon monoxide poisoning. Chest pain. Shock. Smoke inhalation.

### Side effects and special notes

- A. Non-humidified O<sub>2</sub> is drying and irritating to mucous membranes.
- B. Restlessness may be an important sign of hypoxia. Do not let a combative, head-injured patient deter you from application of O<sub>2</sub>.

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## **PHENYLEPHRINE (NEO-SYNEPHRINE)**

### **Pharmacology and actions**

Phenylephrine nasal spray exhibits primarily alpha-adrenergic stimulation. This can produce moderate to marked vasoconstriction and nasal decongestion. Other alpha effects such as mydriasis and pressor effects may be apparent even with topical use to mucous membranes.

### **Indications**

- A. Primarily used prior to nasotracheal intubation to decrease nasal bleeding from intubation trauma.
- B. May relieve ear block and pressure pain with altitude changes by decreasing congestion around eustachian ostia.
- C. May be used to augment the treatment of anterior epistaxis.

### **Precautions**

- A. Use with caution, or do not use electively, in patient with known hypertension, hyperthyroidism, diabetes mellitus, or cardiovascular disease.
- B. The very young or very old patient will be more likely to have idiosyncratic reactions.

### **Administration**

- A. Nasal spray (1%) – 2 sprays in each nostril for **adults**. 1 spray in each nostril for **children or elderly**.
- B. Soak a cotton ball with neosynephrine (squeeze out excess) and place the medicated cotton ball into the affected nare. Continue providing external direct pressure to the nares.

### **Side effects and special notes**

- A. When used to relieve otitic barotrauma, the best results are from pretreatment before descending in altitude. If descending and patient experiences pain – stay level or ascend to comfort level. Administer spray and wait 5–10 minutes if time is not critical. Descend when patient reports comfort and/or ability to "pop" ears.
- B. When used as pretreatment for nasotracheal intubation, the precautions should not cause undue concern. The patient must need airway assistance but not be in extremis.
- C. When using neosynephrine for the control of epistaxis, always attempt direct external nare pressure first.

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## **RACEMIC EPINEPHRINE (VAPONEFRIN)**

### **Pharmacology and actions**

Racemic epinephrine is an epinephrine preparation with a combination of "L" and "D" isomers of epinephrine for use by inhalation only. Effects are those of epinephrine. Inhalation causes local effects on the upper airway as well as systemic effects from absorption.

### **Indications**

- A. Airway obstruction due to croup.
- B. Anaphylaxis in pediatric patients without IV access.

### **Precautions**

- A. Mask and noise may be frightening to small children. Agitation will aggravate symptoms of respiratory obstruction. Try to enlist the support of parents and child.
- B. Try to differentiate croup from epiglottitis by history. Do not use a tongue blade to examine the back of the throat. The diagnosis is frequently difficult in the field, but a critical patient deserves a trial of racemic epinephrine during transport. Although used as specific therapy for croup, it may also buy some time in patients with epiglottitis.
- C. In the less-than-critical patient, saline alone via nebulizer may bring symptomatic relief from croup.
- D. Racemic epinephrine is heat and light sensitive. It should be stored in a dark cool place. Discoloration is an indication to discard medication.

### **Administration**

- A. **Over 2 years** – 0.5 ml racemic epinephrine + 2 ml saline, via nebulizer driven by O<sub>2</sub> (6–8 L/min) to create fine mist.
- B. **2 years or less** – 0.3 ml racemic epinephrine + 2 ml saline, via nebulizer driven by O<sub>2</sub> (6–8 L/min) to create fine mist.

### **Side effects and special notes**

- A. Tachycardia and agitation are the most common side effects. Other side effects of parenteral epinephrine may also be seen. (Since these are also the hallmarks of hypoxia, watch the patient very closely!)
- B. Nebulizer treatment may cause blanching of the skin of the mask area due to local epinephrine absorption. Reassure parents.
- C. If respiratory arrest occurs, it is usually due to patient fatigue or laryngeal spasm. Complete obstruction is not usually present. Ventilate the patient, administer O<sub>2</sub> and transport rapidly. If you can ventilate and oxygenate the patient adequately with pocket mask, or BVM, intubation is best left to a specialist in a controlled setting.

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## SODIUM BICARBONATE

### Pharmacology and actions

Acids are increased when body tissues become hypoxic due to cardiac or respiratory arrest. While respiratory acidosis and mild metabolic acidosis do not require bicarbonate, marked metabolic acidosis may depress cardiac contractility, depress the cardiac response to catecholamines, and may lower the threshold to fibrillation.

### Indications

- A. To correct the suspected acidosis found during cardiac arrest.
- B. Hypotension or dysrhythmias associated with tricyclic antidepressant overdoses.
- C. Therapy for cardiac instability associated with suspected acute hyperkalemia.

### Precautions

- A. Should not be given in mixture with catecholamines or calcium.
- B. May increase cerebral acidosis, especially in diabetics who are ketotic.

### Administration

- A. Solutions
  1. **ADULT / PEDIATRIC** – 8.4% – 1.0 mEq/ml
  2. **INFANTS (30 days old, or less)** – 4.2% = 0.5 mEq/ml. Sodium bicarbonate is administered as half-strength solution(4.2%) for infants 30 days or less. Use premixed pediatric ampules or dilute adult strength 1:1 with saline. Dose is 1 mEq/kg or 2 ml/kg of the 4.2% solution.
- B. For cardiac arrest
  1. **ADULT / PEDIATRIC** – 1 mEq/kg (1 ml/kg). Consider 10 minutes after arrest, then consider 0.5 mEq/kg (0.5 ml/kg) every 10 minutes thereafter until blood gases are available.
  2. **INFANTS (30 days old, or less)** – 1 mEq/kg (2 ml/kg). Consider 10 minutes after arrest then consider 0.5 mEq/kg (1 ml/kg) every 20 minutes thereafter. Sodium bicarbonate is administered as half-strength solution(4.2%) for infants 30 days or less. Use premixed pediatric ampules or dilute adult strength 1:1 with saline. Dose is 1 mEq/kg or 2 ml/kg of the 4.2% solution.
- C. For tricyclic OD with hypotension or prolonged QRS (> 0.10 second) – 1.0 mEq/kg IV, repeat if needed in 10–15 minutes.

### Side effects and special notes

- A. Hyperosmolarity of the blood can occur because the NaHCO<sub>3</sub> is concentrated. This results in cerebral impairment.
- B. In children 10 kg or less, half-strength solution is used to avoid the high concentration of the 8.4% solution. Give slowly also, to prevent rapid fluid shifts and intracranial pressure changes in infants.
- C. Hyperventilation corrects respiratory acidosis by removing CO<sub>2</sub>, which is freely diffusible across cellular and organ membranes. There is little data indicating that therapy with buffers (including bicarbonate) improves outcome.

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## **SUCCINYLCHOLINE (ANECTINE)**

### **Pharmacology and actions**

Succinylcholine is an ultra–short acting depolarizing skeletal muscle relaxant, which is used to chemically paralyze a patient to facilitate intubation.

### **Indications**

Only to facilitate intubation of patients as described in the RSI protocol.

### **Precautions**

- A. Transient increases in intragastric pressure. Use the Sellick’s maneuver immediately upon injection of succinylcholine and continue it until the patient has been intubated or until the patient is able to breathe again on their own and protect their own airway. Have suction available.
- B. Life–threatening hyperkalemia may result with the administration of succinylcholine. Patients that are at risk for hyperkalemia (recent major burns, crush injuries, and multiple trauma, renal failure, and known hyperkalemia) may suffer cardiac arrest with the administration of succinylcholine.
- C. Patients who have a known hypersensitivity to succinylcholine and those who have a history of malignant hyperthermia should never be administered succinylcholine. .

### **Administration**

All patients should be given 2.0 mg/kg intravenously one time only.

### **Side effects and special notes**

- A. Administration of succinylcholine may cause bradycardia and asystole in both adults and children. The incidence of this occurrence is higher in children than adults, and is increased in both age groups by the administration of a second dose of the drug. Pre–treatment with atropine (0.5 mg for adults and children >12 y/o) (0.02 mg/kg for children <12 y/o. Maximum of 0.5 mg per dose. Minimum of 0.1 mg per dose) may prevent this occurrence.
- B. The progression of paralysis normally begins with relaxation of the eyelids (ptosis) and jaw, then progresses to limbs, abdomen, and then diaphragm and intercostal muscles. Ptosis and jaw relaxation will be your first indicators to prepare to place the laryngoscope and upon flaccid paralysis of the patient, intubation should be performed.
- C. Always have suction immediately available and always utilize a Sellick’s maneuver.
- D. The use of induction agents and pre–intubation lidocaine (1.5 mg/kg IV) may blunt the rise in ICP and IOP.
- E. Succinylcholine has no effect on consciousness or pain. Sedative use is required.

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## **TETANUS–DIPHTHERIA VACCINE (Td)**

### **Pharmacology and action**

Td is a tetanus–diphtheria vaccine given to adolescents and adults as a booster shot every 10 years, or after an exposure to tetanus under some circumstances. This vaccine works by exposing you to a small dose of the bacteria or a protein from the bacteria, which causes the body to develop immunity to the disease.

### **Indications**

- A. Pre–employment/employment related if lack of evidence of having received tetanus vaccine in the previous 10 years.
- B. Recent deep and dirty wound (e.g., contaminated with dirt, feces, saliva) and lack of evidence of having received tetanus toxoid–containing vaccine in the previous 5 years.

### **Precautions**

- A. A serious allergic reaction to a prior dose of Td vaccine or a vaccine component is a contraindication to further doses of Td vaccine.
- B. A physician’s consultation is required if history of an unstable neurological condition or history of Guillain–Barré syndrome
- C. Persons with moderate or severe illness on the day any vaccine is scheduled should probably be delayed until full recovery
- D. Paramedics should not administer the Td vaccine to anyone under the age of 18.

### **Administration**

0.5 ml IM (Adult). The Deltoid muscle is the preferred site.

### **Side effects and special notes**

- A. Pain in area of injection site, mild fever, and chills may occur.
- B. In rare cases a severe allergic reaction may occur. If so, follow the Allergy/Anaphylaxis protocol.
- C. Administered doses should be documented on a vaccination record and provided to the recipient as well as maintained in agency records. Documentation should include the manufacturer, lot number, expiration date, dose given, and site of injection. Recipient should read an information sheet and sign an authorization and consent form before administration.
- D. Vaccine should be refrigerated at 36–40 degrees F.
- E. Use of Td is not contraindicated in pregnancy. At a physician’s discretion, either vaccine may be administered during the 2nd or 3rd trimester.

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## **TOPICAL OPHTHALMIC ANAESTHETICS**

### **Pharmacology and actions**

Topical ophthalmic medications have a rapid (15–30 second) onset of anaesthesia with 15–20 minute duration.

### **Indications**

Corneal anaesthesia of short duration for patients presenting with corneal abrasion, chemical burns or irritation.

### **Precautions**

- A. The use of topical ophthalmic anaesthetics is contraindicated in the presence of severe globe injuries. If the integrity of the globe is in question, do not use these agents.
- B. Application of these agents may result in a total relief of symptoms. Therefore, do not apply anaesthetic until the patient consents to transport to an emergency department for definitive care.
- C. The use of these agents shall be considered contraindicated if the patient has any known sensitivity or allergy to any local anaesthetics or to PABA (para-aminobenzoic acid)-containing products.
- D. The long-term/prolonged use of topical anaesthetics can be deleterious (corneal erosions/sloughing, permanent corneal opacification with resultant blindness, etc)  
**DO NOT GIVE THE PATIENT THE BOTTLE.**

### **Administration**

- A. Only the following agents are approved: proparacaine and tetracaine, both in 0.5% preparations.
- B. Use only fresh and unopened bottle for each patient. If discolored (indicating contamination) do not use. Do not touch the tip of the bottle on anything, including the eye, as this may result in contamination of the medication.
- C. Place 2 drops in the effected eye(s). Only one application is allowed in the prehospital setting without specific physician approval.

### **Side effects and special notes**

- A. During the period of anaesthesia protect the patients eyes from further injury. The patient will not be able to feel the introduction of new foreign bodies, chemicals, etc. Do not allow the patient to rub their eyes. Protect the eye from dust and other hazards.
- B. Occasional burning/stinging, lacrimation, and photophobia may occur upon initial instillation of drops. This is usually a transient side effect and occurs less often with proparacaine. However, proparacaine may produce a delayed irritation/stinging to the eyes several hours after administration.
- C. Both agents are associated with a rare, severe, immediate-type hyperallergenic corneal reaction which results in acute, intense, and diffuse epithelial keratitis and sloughing of large areas of necrotic epithelium.

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## **TUBERCULIN PPD, DILUTED**

### **Pharmacology and actions**

Tuberculin purified protein derivative (PPD) is recommended as an aid in the detection of infection with *Mycobacterium tuberculosis*.

### **Indications**

As a routine screening tool for public safety providers

### **Precautions**

- A. Paramedics may not administer vaccine to anyone other than public safety providers.
- B. Contraindicated in persons with previous hypersensitivity to any component of the vaccine, who have previously experienced a severe reaction to testing, or who have known sensitivity to TB.
- C. Avoid injecting tuberculin subcutaneously. Sub Q injection results in no local reaction, but a general febrile reaction and/or acute inflammation around old tuberculous lesions.

### **Administration – by standing order**

- A. Mantoux Test: 0.1 ml intrademally, using a TB syringe fitted with a 25–27 gauge, 1/2 inch needle.
- B. The site of the test is usually the flexor or dorsal surface of the forearm approximately 4 inches below the elbow. The area should be free of lesions and away from veins.
- C. As the tuberculin solution is injected, a pale bleb 6–10 mm in size will rise over the point of the needle. If a bleb does not develop, the solution was injected subcutaneously requiring the test to be repeated in the other arm.
- D. Interpretation of results.
  1. Readings of reactions should be made during the period from 48–72 hours after the injection.
  2. Induration only should be considered in interpreting the test. An induration is a raised, hardened area over the test site.
  3. The diameter of induration should be measured transversely to the long axis of the forearm and recorded in millimeters.
  4. Any induration 5mm or greater warrants referral.
  5. Considered negative if less than 5mm induration.

### **Side effects and special notes**

- A. Side effects include fever and erythema, ulceration, or necrosis at the site.
- B. A positive test does not mean a person has active tuberculosis, but warrants further evaluation.

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## **VASOPRESSIN**

### **Pharmacology and actions**

The endogenous form of vasopressin (antidiuretic hormone – ADH) is a polypeptide hormone which is produced by the hypothalamus and released by the posterior pituitary gland in response to increased plasma osmotic concentration. In addition to retaining water to rectify osmolality (through V2 receptors), vasopressin demonstrates vasoconstrictive properties which are significantly amplified at the higher doses used in the exogenous form during cardiac arrest. Vasopressin is a non-adrenergic vasoconstrictor which binds to the V1 receptors in smooth muscle. The resultant effects of vasopressin administration are shunting of blood from the skin, intestines, fat and muscle; bronchial constriction, increased blood flow to vital organs, increased coronary artery perfusion pressure, increased cerebral oxygen delivery, and an increase in the median frequency of ventricular fibrillation. The half-life of vasopressin is estimated to be 10-20 minutes.

### **Indications**

Cardiac arrest due to ventricular fibrillation, asystole or PEA

### **Precautions**

- A. Since vasopressin is not a beta-adrenergic drug, it does not increase myocardial oxygen demand during states of cardiac arrest; however, increased afterload may contribute to episodes of angina in conscious patients with a history of coronary artery disease.
- B. May cause tissue necrosis with extravasation.

### **Administration**

- A. In cardiac arrest, administer 40 U of vasopressin IV/IO.
- B. Pediatric dosage is 0.4 units/Kg IV/IO. (Use in pediatric patients only when epinephrine is not available).
- C. Repeat doses of vasopressin and/or the addition of epinephrine to vasopressin is controversial. In extraordinarily long cardiac arrest situations, seek direct physician consultation regarding vasopressor therapy before progressing beyond the above-delineated dosing scheme.

### **Side effects and special notes**

Vagally-influenced bradycardias may occur in the post-cardiac arrest period due to increased peripheral vascular constriction.

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## **VECURONIUM BROMIDE (NORCURON)**

### **Pharmacology and actions**

Vecuronium is a short-to-intermediate acting skeletal muscle relaxant, which is used to maintain paralysis of the intubated patient. Unlike succinylcholine, it initiates flaccid paralysis by blocking receptors of the motor end plate, rather than binding to them. Effectively, this action blocks neuromuscular transmission of impulses without depolarizing the muscle. Due to the non-depolarizing nature of this drug, it has less adverse effects in relation to hyperkalemia. Vecuronium is also remarkably free of the traditional histaminic side effects that characterize most other non-depolarizing skeletal muscle relaxants. As such, there are few, if any, cardiovascular side effects with the administration of vecuronium. The paralysis induced by vecuronium is reversible by acetylcholinesterase inhibitors, such as neostigmine. Injection of vecuronium usually produces flaccid paralysis within 2–3 minutes. Effects last for 30 minutes.

### **Indications**

- A. To maintain paralysis of the intubated patient as described in the RSI protocol only after confirmation of correct endotracheal tube placement.
- B. To prevent shivering in TICE protocol patients with a confirmed tube in the trachea

### **Precautions**

- A. Contraindicated in those patients known to have a hypersensitivity to vecuronium.
- B. Patients with severe renal failure and/or hepatic failure may experience prolonged paralysis when given standard doses of the medication.

### **Administration**

- A. Paralyzing dose of 0.1 mg/kg for patients > 12 y/o.
- B. Paralyzing dose of 0.2 mg/kg for children < 12 years of age.
- C. Vecuronium can only be administered intravenously.

### **Side effects and special notes**

- A. Once given vecuronium, the patient will be paralyzed and unable to protect their own airway or breathe on their own for 30 minutes. Assure correctly placed endotracheal tube before this medication is administered.
- B. Vecuronium has no ability to sedate or relieve pain. Therefore, concomitant sedation should be administered to all patients receiving vecuronium, unless hemodynamically unstable.

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## VERAPAMIL

### Pharmacology and action

Verapamil is a derivative of papaverine. It acts as a slow calcium channel blocker.

- A. Slows conduction and prolongs refractoriness in AV node.
- B. Slows ventricular response to atrial flutter and fibrillation.
- C. Vasodilator effect on vascular smooth muscle, including coronary arteries.
- D. Negative inotrope, which decreases myocardial oxygen consumption.

### Indications

- A. Treatment of paroxysmal supraventricular tachycardia (PSVT) in patient who does not require cardioversion and is unresponsive to adenosine.
- B. May be useful to slow the ventricular response to atrial flutter or fibrillation in symptomatic patients.

### Precautions

- A. Vagal maneuvers and adenosine are safer and should be attempted before verapamil is considered.
- B. Not for use in patients who are hemodynamically unstable with severe hypotension or congestive heart failure. Patients who appear critical with rapid, narrow complex tachydysrhythmias should be **CARDIOVERTED**.
- C. Verapamil should be used with caution or avoided in patients who are taking beta-adrenergic blocking agents.
- D. Contraindicated in patients with sick sinus syndrome or AV block in the absence of a functional artificial pacemaker.
- E. Contraindicated for atrial flutter or fibrillation in patients with history of WPW (Wolff-Parkinson-White) or LGL (Lown-Ganong-Levine) syndromes.

### Administration

- A. **Adult** – 2.5–5.0 mg slowly IV (over 2–3 minutes). May administer additional 5–10 mg if no response in 30 minutes.
- B. **Pediatric** – Not indicated for field use.

### Side effects and special notes

- A. Transient drop in the arterial pressure is expected. However, with occasional severe hypotension, treatment may be necessary. If so, considered: IV fluids, dopamine, calcium, or glucagon. Consult base physician.
- B. Electrical activity through the SA and AV nodes depends on a significant degree upon calcium influx through the slow channel. By blocking that response, patients with prior nodal disease can develop sinus arrest, third degree heart block or asystole. These complications may require: calcium, atropine, glucagon or cardiac pacing. Consult physician.
- C. Verapamil can cause severe hypotension, shock, and ventricular fibrillation when administered to a patient in ventricular tachycardia. It should not be used to differentiate PSVT from VT. When in doubt treat rhythm as ventricular tachycardia by using lidocaine.

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