PHARMACOLOGY HANDBOOK

Revised 2011 by VCEMS Agency ALS CQI Team in conjunction with Ventura College School of Prehospital and Emergency Medicine

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www.vchca.org/ph/ems

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ACTIVATED CHARCOAL

Classification: Chemical adsorbent

Actions: Adsorbs drugs and chemicals in the gastrointestinal tract

Indications: Oral poisoning/overdose of drugs or chemicals, with time of ingestion at or under one hour.

Contraindications:

- Ingestion of caustics, corrosives, or petroleum distillates
- Ingestion of cyanide and/or heavy metals
- Altered or decreased LOC
- No intact gag reflex

Adverse Effects:

Gastrointestinal

- Nausea
- Vomiting

Respiratory

- Aspiration

Dosage Information: Refer to VCEMS Policy 705 for specific dosages

Route of administration: PO

Onset: Immediate

Duration: Continuous while in GI tract

Notes:

- Activated charcoal should only be administered to patients who can hold the bottle and drink without assistance
- Must be shaken vigorously prior to administration

ADENOSINE (Adenocard®)

Classification: Antidysrhythmic agent

Actions:
- Depresses automaticity in the SA node
- Suppresses AV conduction
- Interrupts re-entry pathways through the AV node

Indication: Patient in moderate distress due to SVT refractory to Valsalva maneuver

Contraindications:
- History of sick sinus syndrome (unless patient has functioning electronic pacemaker)
- 2° or 3° heart block

Adverse Effects:

Cardiovascular
- Chest pain/pressure
- Transient PAC's/PVC's
- Asystole
- Hypotension
- Bradycardia
- 2°/3° heart blocks

Respiratory
- Dyspnea
- Bronchoconstriction in patients with asthma/COPD

Metabolic
- Flushed skin

Neurological
- Headache / blurred vision
- Tingling / numbness
- Lightheadedness / dizziness
- Seizures

Gastrointestinal
- Nausea
- Metallic taste
- Throat tightness

Dosage Information: Refer to VCEMS Policy 705 for specific dosages

Route of administration: IV

Onset: Immediate

Duration: 1-2 minutes

Notes:
- Adenosine is to be administered in a rapid IV push. Draw up 10-20 mL of normal saline (NS) in another syringe, and administer the adenosine rapidly followed by the syringe of NS.
- Run a continuous ECG strip before, during, and after adenosine administration.
- Adverse effects usually resolve spontaneously within 1-2 minutes.
- Adenosine will not be effective on A-fib or A-flutter because it only operates on the AV node, not on the inter-nodal pathways. If given for WPW with wide complex (irregular) atrial fibrillation, it may result in VF. Though not recommended for VT, it is generally safe. However, adenosine may cause 2° and 3° heart blocks.

- Adenosine may produce transient blocks for diagnosis of rapid tachydysrhythmias that are not easily distinguishable as A-fib or A-flutter. This is known also as a “chemical Valsalva.”
- Adenosine is naturally occurring and is found in all body cells as adenosine triphosphate (ATP).
- Persantine® (dipyridamole) inhibits the transport and potentiates the effects of adenosine. Tegretol® (carbamazepine) may potentiate the degree of AV block caused by adenosine. Contact base before giving adenosine to a patient that is taking either of these medications.

ALBUTEROL

Classification: Bronchodilator (Beta-2 specific)

Actions:
- Relaxes bronchial smooth muscle
- Decreases airway resistance
- Promotes reuptake of potassium into cells

Indication:
- Respiratory distress with wheezes/bronchospasm
- Anaphylaxis with wheezes
- Crush syndrome with suspected hyperkalemia

Contraindications: Known hypersensitivity to Albuterol

Adverse Effects:

Neurological
- Tremors
- Headache/dizziness
- Sweating
- Anxiety

Cardiovascular
- Tachycardia
- Hypertension
- Dysrhythmias
- Palpitations

Gastrointestinal
- Nausea / vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific dosages

Route of administration: Inhaled

Onset: 5-15 minutes

Duration: 3-6 hours

Notes:
- Albuterol should be administered with oxygen, and be sure to closely monitor the patient's vital signs and cardiac status
- Beta-blocking agents inhibit the effects of albuterol
- The standard preparation of albuterol is in a premix with saline at 0.083% potency

AMIODARONE

Classification: Antiarrhythmic

Actions: Suppresses ventricular ectopy by prolonging the action potential and refractory periods. Slows the sinus rate and increases the PR and QT intervals.

Indication:

- Cardiac arrest with ventricular fibrillation or pulseless ventricular tachycardia
- Post-conversion after defibrillation of ventricular rhythms
- Ventricular tachycardia with pulse present
- Symptomatic/malignant ventricular ectopy

Contraindications:

- Cardiogenic Shock
- 2° AV heart block
- 3° AV heart block
- Severe sinus node dysfunction
- Ventricular ectopy associated with bradycardia
- Hypersensitivity to amiodarone or iodine
- Pregnancy or breastfeeding mothers

Adverse Effects:

Cardiovascular

- Bradycardia
- Hypotension
- CHF
- Worsening of dysrhythmias

Neurological

- Dizziness
- Fatigue
- Malaise
- Confusion
- Headache
- Disorientation
- Hallucinations

Respiratory

- Adult Respiratory Distress Syndrome (ARDS)

Gastrointestinal

- Nausea / vomiting
- Anorexia
- Constipation

VCEMS Policy 705:

1. Cardiac Arrest – VF/VT
2. Chest Pain – Acute Coronary Syndrome **(BH, MD order ONLY)**
3. Ventricular Tachycardia Sustained – Not in Arrest

Route of administration: IV/IO/IVPB

Onset: 2-5 minutes

Duration: variable

Notes:

- Amiodarone is to be administered no faster than 150mg/10 min (15mg/min), except in patients in cardiac arrest.

ASPIRIN (Acetylsalicylic Acid, ASA)

Classification: Nonsteroidal anti-inflammatory (NSAID) – anti-thrombotic, analgesic, antipyretic, anti-inflammatory

Actions:
- Inhibits prostaglandin synthesis
- Irreversibly inactivates the enzyme cyclooxygenase in circulating platelets

Indication: Adult patients experiencing chest pain consistent with acute coronary syndrome

Contraindications:

ABSOLUTE:
- Anaphylaxis to aspirin or other salicylates

RELATIVE: Patients who have any one of the following:
- History of GI bleeding
- History of asthma
- Bleeding disorders (e.g. hemophilia, low platelets)

Adverse Effects:

Respiratory
- Bronchospasm
- Asthma-like symptoms
- **Gastrointestinal**
- Nausea/vomiting
- Gastric upset
- GI bleeding
- Potentiation of peptic ulcer

Other
- Skin Rash
- Anaphylaxis
- Prolonged bleeding

Dosage Information: Refer to VCEMS Policy 705 for specific dosages

Route of administration: PO

Onset: 15 minutes

Duration: 2-4 hours

Notes:
- The patient should be advised to chew the tablets prior to swallowing
- Aspirin will increase the risk of bleeding especially when combined with anticoagulants and thrombolytic therapy

ATROPINE SULFATE

Classification: Anticholinergic agent

Actions:

- Inhibits parasympathetic stimulation by blocking acetylcholine at the muscarinic receptors
- Decreases vagal tone resulting in increased heart rate (chronotropic) and AV
- conduction (dromotropic)
- Dilates bronchioles and decreases respiratory tract secretions
- Decreases gastrointestinal motility

Indication:

- Symptomatic bradycardia
- Organophosphate poisoning
- Nerve agent poisoning

Contraindications: None significant in the above indications

Adverse Effects:

Neurological
- Restlessness
- Seizures
- Pupillary dilation
- Blurred vision/dizziness
- Confusion

Cardiovascular
- Tachycardia
- Greater oxygen demand
- Paradoxical bradycardia

Other
- Worsens glaucoma
- Flushed/hot/dry skin

Respiratory
- Mucous plugs

Gastrointestinal
- Dry mouth
- Difficulty swallowing

Dosage Information: Refer to VCEMS Policy 705 for specific dosages

Route of administration: IV/IO/IM

Onset: Rapid

Duration: 2-6 hours

Notes:

- In a patient with suspected myocardial ischemia and first dosage is ineffective, use caution with repeat dosages as they may exacerbate myocardial infarction
- If patient is in a second or third degree heart block, and the take-over rhythm is of a wide complex nature, atropine may cause a decrease in the heart rate
- Paradoxical slowing is caused by the slow administration of the drug. This may cause stimulation of the vagus nerve. If the first dose slows the heart rate, the second dose should be withheld
- The acronym “SLUDGE” is used to represent the various signs/symptoms of an organophosphate

poisoning. These signs/symptoms include increased salivation, lacrimation, urination, defecation, gastrointestinal distress, and emesis. Some common organophosphates include bug bombs, roach/ant sprays, flea and tick collars, and common garden sprays. Atropine is the drug of choice in this situation since it prevents the over-stimulation of the muscarinic receptors

- When given for nerve agent poisoning, utilize only the IM route when the patient is in the Hot/Warm Zone. If the patient is in the Cold Zone, the IM or IV route may be used

CALCIUM CHLORIDE (CaCl)

Classification: Electrolyte

Actions:
- Acts as an activator in transmission of nerve impulses and contraction of cardiac, skeletal, and smooth muscles
- Maintains cell membrane and capillary permeability

Indication:
- Cardiac arrest or symptomatic bradycardia associated with hyperkalemia (suspect in renal failure)
- Calcium channel blocker overdose
- Crush injuries with dysrhythmia

Contraindications:
- Hypercalcemia
- Patient with digitalis toxicity

Adverse Effects:

Cardiovascular
- Cardiac arrest

Metabolic
- Hypercalcemia

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IO

Onset: 5-15 minutes

Duration: 4 hours

Notes:
- Flush IV tubing between administration of calcium chloride and sodium bicarbonate.
- Monitor ECG closely for dysrhythmias, especially in patients taking digitalis

DEXTROSE 5% IN WATER (D_5W)

Classification: Hypotonic solution

Actions:
- Provides a medium for IVPB medication administration
- Provides a small amount of dextrose for cellular metabolism

Indication: Dilution solution for IVPB medications

Contraindications: None

Adverse Effects:

Metabolic
- Increases free water and may lead to edema if large amounts are infused

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IVPB

Onset: Immediate

Duration: Remains in intravascular space for 20-40 minutes

Notes:
- Dextrose is quickly metabolized, leaving behind water. Over time, this water will move into the interstitial space. For this reason, D_5W is not the fluid of choice for fluid challenge or resuscitation.

DEXTROSE 50% ($D_{50}W$) and DEXTROSE 25% ($D_{25}W$)

Classification: Hyperglycemic agent

Actions: Increases blood sugar

Indication: Hypoglycemia

Contraindications:
- Suspected increased ICP with unknown blood glucose level
- Suspected CVA with unknown blood glucose level

Adverse Effects:

Metabolic
- Pain/burning at injection site
- Tissue necrosis
- Hyperkalemia

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: **IV/IO**

Onset: Immediate

Duration: Dependent upon patient metabolism and degree of hypoglycemia

Notes:
- Create dextrose 25% in water ($D_{25}W$) by removing 25 mL of $D_{50}W$ solution and drawing up 25 mL normal saline as a replacement
- Dextrose 50% in water is a concentrated solution and is very irritating to the venous tissue. Cannulate as large of a vein as possible. Aspirate prior to administration and every 5-15 mL thereafter to ensure IV patency
- $D_{50}W$ is the drug of choice for hypoglycemic patients when oral forms of glucose are contraindicated

DIAZEPAM

Reference is for Nerve Agent Poisoning policy if the CHEMPACK pharmaceutical stockpile is deployed

Classification: Anticonvulsant / Tranquilizer

Actions:
- Promotes muscle relaxation through inhibition of spinal motor reflex pathways
- Suppresses seizure activity through suppression of the motor cortex of the brain
- Produces amnesic effect
- Skeletal muscle relaxant

Indication: Active/continuous seizures lasting longer than 5 minutes

Contraindications: No absolute contraindications exist when Diazepam is deployed for nerve agent exposure

Adverse Effects:

Cardiovascular
- Hypotension

Neurological
- Dizziness
- Ataxia
- Fatigue
- Pain/burning at injection site

Respiratory
- Depression
- Apnea

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IM/IO

Onset: 1-5 minutes

Duration: 15 minutes to 1 hour

Notes:
- Do not use in a patient with hypotension, sign/symptoms of shock, or (actual or possible) respiratory depression unless treating prolonged seizures. Monitor vital signs frequently (if possible)

DIPHENHYDRAMINE (Benadryl®)

Classification: Antihistamine

Actions:
- Reverses histamine induced bronchospasm, vasodilation, and increased capillary membrane permeability
- Relaxes smooth muscle

Indication:
- Anaphylaxis
- Acute allergic reaction
- Extrapyramidal/dystonic reactions

Contraindications:
- Narrow angle glaucoma
- Pregnancy
- Acute asthma

Adverse Effects:

Cardiovascular
- Hypotension
- Palpitations
- Tachycardia

Neurological
- Drowsiness/confusion
- Decreased coordination
- Blurred vision

Gastrointestinal
- Dry mouth

Respiratory
- Mucous plugs

Other
- Urinary retention

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IM

Onset:
- IV – rapid
- IM – 20-30 minutes

Duration: 4-8 hours

Notes:
- Closely monitor blood pressure and cardiac status before and after administration of diphenhydramine. Reassess respiratory status and lung sounds after administration
- Histamines are found in nearly all tissues of the body and are released after skin damage or inflammation. Histamines cause relaxation of smooth muscle and vasodilation, which may induce severe hypotension
- Histamine release can lead to increased capillary permeability and leaking. The intravascular fluid leaks through dilated capillary pores and may result in pulmonary or laryngeal edema. This leaking fluid also leads to edema of the skin (hives/urticaria). Diphenhydramine works by blocking further release of histamines
- Dystonic reaction signs and symptoms include eye deviation, head jerking, dysphasia, involuntary arm/leg twitching, and hypotension

DOPAMINE (INTROPIN®)

Classification: Sympathomimetic agent (catecholamine)

Actions:

Low Dose: 1-2 mcg/kg/min (renal/dopaminergic receptors)
- Dilates renal and mesenteric arteries by stimulating dopaminergic receptors causing diuretic effect
- May decrease BP due to vasodilation

Moderate Dose: 2-10 mcg/kg/min (Beta receptors)
- Increases inotropy and may increase chronotropy
- Increases BP by stimulating Beta-1 receptors increasing cardiac output with small increase in peripheral vascular resistance

High Dose: Over 10 mcg/kg/min (primarily Alpha receptors, some Beta receptors)
- Causes peripheral vasoconstriction
- Increases inotropy and chronotropy
- Increases BP by stimulating Alpha and Beta-1 receptors

Indication:
- Symptomatic bradycardia persisting after prior therapies
- Cardiogenic shock with signs/symptoms of CHF or not responding to fluid challenge
- Continued shock with ongoing, extended patient entrapment

Contraindications:
- Hypovolemia
- Tachydysrhythmias

Adverse Effects:

Cardiovascular
- Tachycardia
- Hypertension
- Increased O_2 demand
- Ventricular irritability
- Chest pain

Respiratory
- Dyspnea

Gastrointestinal
- Nausea/Vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IVPB

Onset: 1-2 minutes

Duration: < 10 minutes

Notes:
- Transcutaneous pacing is the preferred step after atropine in the treatment of symptomatic bradycardias refractory to atropine
- Consider expediting transport in cases requiring dopamine administration
- Dopamine may be inactivated by alkaline solutions such as sodium bicarbonate
- Start in the largest possible vein and ensure patency prior to administration, as dopamine is likely to cause tissue necrosis upon entering the interstitial space
- Establish a second IV line for other medications, as the dopamine infusion should not be interrupted. In the event that the dopamine infusion must be terminated in the field, gradually taper off the IVPB

infusion at 5mcg/kg/min

- In the upper end of the moderate dosage range, Alpha receptors are stimulated and peripheral vasoconstriction occurs
- In the high dose range, Alpha receptors override the dopaminergic receptors, resulting in decreased renal and mesenteric perfusion

EPINEPHRINE (Adrenalin®)

Classification: Sympathomimetic agent (catecholamine)

Actions:
- Increases cardiac output due to increased inotropy, chronotropy, dromotropy, and AV conduction (Beta-1)
- Relaxes smooth muscles of the respiratory tract (Beta-2)
- Increases systolic blood pressure due to increased cardiac output (Beta-1) and vasoconstriction (Alpha)
- Increases coronary perfusion during CPR by increasing aortic diastolic pressure

Indication:
- Cardiopulmonary arrest
- Anaphylaxis
- Respiratory distress with wheezing
- Pediatric symptomatic bradycardia
- Suspected croup

Contraindications: None in above situations

Adverse Effects:

Cardiovascular
- Tachycardia
- Hypertension
- Chest pain
- Palpitations
- Ventricular fibrillation

Neurological
- Anxiety
- Dizziness
- Headache
- Tremors
- Seizures

Gastrointestinal
- Nausea/vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IO/IM

Onset: IV/IO – rapid
IM – 6-12 minutes

Duration: IV/IO – 20 minutes
IM – 1-4 hours

Notes:
- Use epinephrine with caution in older patients. If patient is clearly in anaphylaxis, this is the drug of choice, even in older patients. If doubt exists, initiate early base hospital contact, prior to drug therapy.
- Tachycardia is not a contraindication to epinephrine.

FUROSEMIDE (Lasix)

Classification: Diuretic

Actions:
- Increases urinary output by inhibiting the reabsorption of sodium in the renal tubules and the Loop of Henle.
- Causes vasodilation and venous pooling

Indication: Pulmonary edema / congestive heart failure

Contraindications:
- Pregnancy
- Rales due to pneumonia
- Patient is not currently taking oral Lasix or Bumex

Adverse Effects:

Cardiovascular
- Postural hypotension
- Syncope
- Dehydration

Neurological
- Confusion
- Headache
- Blurred vision
- Tinnitus or hearing loss

Gastrointestinal
- Nausea/vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: **IV**

Onset: 15-20 Minutes

Duration: 2 hours

Notes:
- Rapid administration may result in permanent hearing loss due to cranial nerve damage.
- Lasix is contraindicated if the patient is not currently prescribed Lasix or Bumex (bumetanide). Unless ordered specifically by the base hospital, paramedics may only administer Lasix to patients that are currently prescribed Lasix or Bumex.
- For dosage matching purposes, 40mg of Lasix is equivalent to 1mg of Bumex (40:1 ratio).
- Furosemide is a sulfonamide derivative and may induce allergic reactions in some individuals sensitive to sulfonamides (sulfa). Base hospital notification of patient allergies is essential prior to furosemide administration.
- Prehospital therapy with furosemide is contraindicated for patients with rales due to circumstances other than pulmonary edema secondary to congestive heart failure (e.g. – pneumonia).

GLUCAGON

Classification:
- Hyperglycemic agent
- Pancreatic hormone

Actions:
- Stimulates breakdown of glycogen in the liver to increase blood sugar
- Increases inotropy and chronotropy

Indication:
- Known or suspected hypoglycemia when unable to administer D_{50}/D_{25} or oral glucose.
- Cardiac arrest with beta blocker or calcium channel blocker overdose.
- Seizure with blood sugar < 60 mg/dL

Contraindications: None in the field setting

Adverse Effects: **Gastrointestinal**
- Nausea/vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IO/IM

Onset:
- IV/IO – 1 minute
- IM – within 10 minutes

Duration: 10-30 minutes

Notes:
- Caution is advised in administration to a patient with cardiovascular disease due to inotropic and chronotropic effects.
- Glucagon is packaged as a powder that must be reconstituted prior to administration.
- Glucagon takes effect via conversion of stored glycogen in the liver. If the patient is low in stored glycogen due to alcoholism or malnutrition, glucagon will be less effective.

HEPARIN

Classification: Anticoagulant

Actions: Inhibits normal blood clotting

Indication:
- Prevention of clot formation/growth in DVT, MI, pulmonary emboli
- Atrial fibrillation with emboli formation
- Transfusion, dialysis and surgical procedures

Contraindications:
- Bleeding disorders, blood dyscrasias, leukemia with bleeding
- Peptic ulcer disease
- Severe hepatic or renal disease
- Hypertension
- Sensitivity to heparin
- Sub-acute bacterial endocarditis

Adverse Effects:

Gastrointestinal
- Nausea/vomiting
- Hemoptysis
- Hematuria, diarrhea
- Black tarry stools
- Anorexia
- Abdominal cramps

Other
- Epistaxis
- Petechiae/rash/urticaria
- Fever/chills
- Bruising

Dosage Information: IFT only (Refer to VCEMS Policy 722)

Route of administration: IVPB

Onset: Immediate

Duration: 2 - 6 hours (dose and metabolism dependent)

Notes:
- Ventura County paramedics are **not** allowed to add heparin to any IV solution. Policy 722 allows a paramedic to monitor and transport patients with a heparin infusion in progress as long as they have successfully completed an employer training program that has been approved by Ventura County EMS. Heparin concentrations will not exceed 100units/mL for transport. Drip rates must remain constant (except to turn off the infusion completely as needed) and the maximum drip rate is 1600 units/hour. Rates and/or concentrations above these amounts cannot be transported by paramedics.
- Avoid IM injections or other procedures that may cause bleeding.

LIDOCAINE (Xylocaine®) 2% Cardiac

Classification:
Antiarrhythmic
Anesthetic

Actions:
Local anesthesia

Indication:
For responsive patients, slow infusion of 2% cardiac lidocaine over 60 seconds prior to intraosseous fluid/medication administration

Contraindications:
- 2° AV heart block
- 3° AV heart block
- Junctional bradycardia
- Ventricular ectopy associated with bradycardia
- Idioventricular rhythm

Adverse Effects:

Cardiovascular
- Bradycardia
- Hypotension

Neurological
- Dizziness
- Drowsiness
- Parasthesia
- Blurred vision
- Restlessness
- Disorientation
- Seizures
- Lightheadedness
- Tinnitus
- Muscle twitching
- Slurred speech

Respiratory
- Dyspnea
- Depression/apnea

Gastrointestinal
- Nausea / vomiting

Dosage Information:
Slow infusion over 60 seconds prior to fluid/medication administration for pain management.
3-39 kg: 1 mg/kg
≥40 kg: 40 mg

Route of administration:
IO

Onset:
Immediate

Duration:
10-20 minutes

MAGNESIUM SULFATE ($MgSO_4$)

Classification: Electrolyte

Actions:
- Essential for the activity of many enzymes
- Plays an important role in neurotransmission and muscular excitability
- Acts as a physiological calcium channel blocker and blocks neuromuscular transmission of calcium

Indication:
- Seizures in 3rd trimester pregnant patient without prior seizure disorder
- Ventricular fibrillation refractory to Lidocaine
- Torsades de pointes

Contraindications:
- Hypotension
- Renal failure
- Complete heart block
- Hypermagnesemia

Adverse Effects:

Cardiovascular
- Dysrhythmias
- Bradycardia
- Hypotension

Gastrointestinal
- Diarrhea

Musculoskeletal
- Muscle weakness

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IVPB

Onset: Immediate

Duration: 30 minutes

Notes:
- Slow or stop infusion if bradycardia, heart block or decreased respiratory effort occur
- When giving $MgSO_4$ by IV, have Calcium Chloride (CaCl) available for IV injection in the event of $MgSO_4$ toxicity (hypotension, respiratory depression)

MIDAZOLAM (Versed®)

Classification: Sedative / Hypnotic

Actions: Central nervous system depressant

Indication:
- Seizure in adults and children
- Sedation prior to cardioversion of SVT and VT
- Need for chemical restraint due to severe agitation
- Seizures secondary to nerve agent poisoning

Contraindications:
- Shock / hypotension
- Alcohol or other CNS depressant use
- Known allergy or hypersensitivity to benzodiazepines

Adverse Effects:

Cardiovascular
- Cardiac arrest
- Hypotension

Neurological
- Stupor/coma
- Paradoxical agitation

Respiratory
- Depression/apnea

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IM

Onset:
- IV – 1-5 minutes
- IM – 15 minutes

Duration: IV/IM – 2-6 hours

Notes:
- The most common complication in the treatment of seizures with benzodiazepines is hypoventilation/respiratory depression and apnea. The patient must be closely and continuously observed after cessation of seizure activity.
- Prehospital provider agencies will only stock the 5mg/mL vial
- To prepare Midazolam for IV use, dilute 5mg (1mL) with 4mL of normal saline for a final volume of 5mL. This will provide a final concentration of 1mg/mL.

MORPHINE SULFATE

Classification: Opiate (narcotic analgesic)

Actions:

- Acts directly on the CNS at the opiate receptor sites to relieve pain and anxiety
- Decreases myocardial oxygen demand
- Causes venous pooling due to peripheral vasodilation secondary to mild histamine release
- Reduces preload and afterload through relaxation of the sympatheti nervous system

Indication:

- Chest pain associated with acute coronary syndrome
- Burns
- Situations in which pain control is a significant factor

Contraindications:

- Significant traumatic injury to the head, chest, or abdomen
- Hypotension/shock

Adverse Effects:

Cardiovascular

- Tachycardia
- Bradycardia
- Cardiac Arrest
- Hypotension

N**eurological**

- Headache
- Hallucinations
- Dizziness
- Tremors/seizures
- ALOC/agitation

Respiratory

- Depression/apnea

Gastrointestinal

- Nausea/vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IM

Onset:

- IV – Rapid
- IM – 10-30 minutes

Duration: IV/IM – 4-5 hours

Notes:

- Have naloxone readily available in the event of an opiate-induced respiratory depression or apnea
- Place patient on oxygen, pulse oximetry and ECG prior to administration
- Hypotension caused by morphine can be treated by shock position and/or fluid challenge
- Unless ordered by the BH physician, morphine should not be given for the purpose of pain control in patients in shock or with significant head, chest or abdominal trauma

NALOXONE HYDROCHLORIDE (Narcan®)

Classification: Narcotic antagonist

Actions:
- Displaces narcotics from opiate receptor sites
- Reverses respiratory depression, sedation, and pupillary effects of narcotics

Indication: Respiratory depression/apnea associated with suspected narcotic overdose

Contraindications: Newborn patients

Adverse Effects:

Cardiovascular
- Tachycardia
- Hypertension

Neurological
- Pupillary dilation

Gastrointestinal
- Nausea/vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IO/IM

Onset:
- IV/IO – 1-2 minutes
- IM – 2-5 minutes

Duration:
- IV/IO – 45 minutes
- IM – >45 minutes

Notes:
- Naloxone should be administered after blood glucose test has been accomplished and D_{50} (if required) has been administered. If suspected narcotic overdose, field personnel may administer Naloxone while blood glucose determination is in progress.
- The use of Naloxone is contraindicated in neonates where mother is known or suspected to be narcotic dependent, or in a patient who is narcotic dependent, as it may cause withdrawal symptoms. Early base hospital contact is advised.
- Administer Naloxone prior to intubation in a patient with severe respiratory depression when narcotic-induced coma is suspected.
- Naloxone should only be given for a respiratory rate under 12 and should not be given as a diagnostic agent for altered level of consciousness.
- For instances where a strong suspicion exists that the primary reason for the patient's altered level of consciousness is narcotic-related, give 2mg Naloxone IM prior to IV therapy. If patient is alert and oriented after Naloxone, the IV may be withheld.
- Policy 613 (DNR) states that in a situation when a patient has an operative DNR, and if the patient is taking high doses of opioid medication, and has decreased respiratory drive, early base hospital contact should be made before administering Naloxone. If base hospital contact cannot be made, Naloxone should be administered sparingly, in doses no more than 0.1 mg every 2-3 minutes.

NITROGLYCERIN (Nitrostat®)

Classification: Vasodilator

Actions:
- Dilates coronary vessels enhancing coronary perfusion
- Reduces coronary vasospasm
- Decreases myocardial workload and oxygen demand
- Relaxes vascular smooth muscle, resulting in peripheral vasodilatation
- Produces venous pooling due to vasodilatation
- Reduces preload and after load

Indication:
- Chest pain associated with acute coronary syndrome
- Pulmonary edema associated with congestive heart failure

Contraindications:
- Head trauma or suspected increased intracranial pressure
- Hypotension (see Notes)
- Hypovolemia/severe anemia
- History of recent erectile dysfunction medication usage (see notes)

Adverse Effects:

Cardiovascular
- Tachycardia/palpitations
- Orthostatic hypotension

Neurological
- Headache
- Increased ICP
- Dizziness/syncope

Other
- Flushed skin
- Sublingual burning

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration:
- SL or lingual spray
- IV – IFT only (Refer to VCEMS Policy 722)

Onset: 1-3 minutes

Duration: 30-60 minutes

Notes:
- Patients can develop tolerance to nitroglycerin.
- If administered via spray, hold can upright and do not shake can.
- Administering personnel must ensure to wear gloves to avoid inadvertent skin absorption.
- Nitroglycerin must be stored in a glass vial away from light and tends to lose potency once exposed to air. The possibility that a patient's personal nitroglycerin may have lost potency must be kept in mind when a patient takes nitroglycerin for symptoms without relief. Check the expiration date as well.
- Ventura County paramedics are **not** allowed to add nitroglycerin to any IV solution. Policy 722 allows a paramedic to monitor and transport patients with a nitroglycerin infusion in progress as long as they have successfully completed an employer training program that has been approved by Ventura County EMS. Nitroglycerin concentrations will not exceed 50mg/250mL for transport. Drip rates must remain constant (except to turn off the infusion completely as needed) and the maximum drip rate is 50 mcg/min. Rates and/or concentrations above these amounts cannot be transported by paramedics.

- Nitroglycerin should not be given to a patient with a systolic blood pressure less than 100mmHg. The exception to this is when a patient with a complaint of **chest pain** has a normal systolic BP of less than 100mmHg. In this circumstance, VCEMS policy allows for nitroglycerin administration unless the systolic BP is less than 90mmHg.
- Pre-hospital therapy with nitroglycerin is contraindicated for patients with rales due to circumstances other than pulmonary edema secondary to congestive heart failure (e.g. – pneumonia).
- Erectile dysfunction drugs such as Viagra/Revatio (sildenafil), Levitra (vardenafil) and Cialis (tadalafil) may have a cumulative vasodilatory effect when used in conjunction with nitroglycerin. If recently used (Viagra or Levitra within 24 hours; Cialis within 48 hours), nitroglycerin may only be given by BH physician order.

ONDANSETRON (Zofran®)

Classification: Antiemetic

Actions:
- Blocks the effects of serotonin ($5HT_3$) receptor sites peripherally, centrally and its release in the small intestine
- Reduces the activity of the vagus nerve from activating the vomiting center in the medulla oblongata

Indication:
- Moderate to severe nausea and vomiting associated with cancer chemotherapy and post-surgical patients
- Potential airway compromise secondary to suspected/actual head injury

Contraindications:
- Patients < 4 years old
- Allergies to ondansetron or
  - alosetron (Lotronex)
  - dolasetron (Anzemet)
  - granisetron (Kytril)
  - palonosetron (Aloxi)

Adverse Effects:

Neurological
- Headache
- Dizziness

Gastrointestinal
- Constipation

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IM/PO

Onset: IV/IM/PO – Rapid

Duration:
- IV/PO – 4-8 hours
- IM – Unknown

Notes:
- IV Ondansetron may cause syncope if delivered too rapidly. Give IV doses over a minimum of 30 seconds
- Remember to consider treatable causes and conditions secondary to prolonged vomiting, dehydration and shock

ORAL GLUCOSE

Classification: Hyperglycemic agent

Actions: Provides an oral source of glucose rapidly utilized for cellular metabolism

Indication: The patient has a history of diabetes controlled by medication and shows signs or symptoms of altered mental status.

Contraindications: Inability to swallow and protect their airway (patient must have an intact gag reflex).

Adverse Effects:

Respiratory
- Aspiration

Gastrointestinal
- Nausea / vomiting

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: PO

Onset: Rapid

Duration: Brief

Notes:
- Administer ONLY to patients with an intact gag reflex and the ability to swallow.
- The oral preparation of glucose may be administered by placing one inch of paste onto a tongue depressor at a time.
- Glucose is hyperosmolar and may cause nausea and vomiting.

OXYGEN (O_2)

Classification: Elemental Gas (Room air contains 21% oxygen)

Actions:
- Oxidizes glucose to provide cellular energy
- Essential for normal aerobic metabolism

Indication: Whenever oxygen demands are increased

Contraindications: No absolute contraindications exist in the field

Adverse Effects: High dosages of oxygen for prolonged periods (> 24 hours) in the COPD patient may cause respiratory depression/apnea

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: Inhaled

Onset: 1-2 minutes

Duration: Up to 30 minutes

Notes:
- Never withhold oxygen from a patient in respiratory distress**.** Use caution with COPD patients who have a chief complaint other than respiratory distress. In the COPD patient, hypoxic drive may be their stimulus to breathe. If respiratory depression occurs, support ventilations with 100% oxygen via BVM.
- Current AHA guidelines recommend supplemental oxygen to maintain a SpO2 > 94%.
- Dosage range of oxygen delivery devices:

• Nasal cannula:	2-6 L/min	25-40% concentration
• Mask:	10-15 L/min	50-60% concentration
• NRB Mask:	10-15 L/min	90-95% concentration
• BVM with reservoir:	15 L/min	40-90% concentration
• ET with BVM:	15 L/min	100% concentration

POTASSIUM CHLORIDE (KCl)

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Classification: Electrolyte

Actions: Regulates nerve conduction and muscle contraction

Indication: Potassium deficiency

Contraindications: None significant during inter-facility transport

Adverse Effects:

Cardiovascular
- Dysrhythmias
- Cardiac arrest

Respiratory
- Depression/arrest

Neurological
- Paresthesia
- Muscular paralysis
- Confusion

Gastrointestinal
- Nausea/vomiting
- Abdominal pain

Other
- Hyperkalemia
- Venous thrombus

Route of administration: IVPB – IFT only

Notes:
- Ventura County providers are not allowed to add potassium chloride to any IV solution. Ventura County policy allows only monitoring of potassium chloride solutions at a TKO rate. Any other rate needs a transport RN with an infusion pump.
- Ventura County policy allows paramedics to monitor up to 20mEq/L for transport
- Potassium chloride may precipitate dysrhythmias. Patients with potassium chloride drips need to have a cardiac monitor during transport
- Potassium chloride causes tissue necrosis if infused into interstitial space. Check IV for patency and infiltration during transport.

SODIUM BICARBONATE

Classification: Alkalinizing agent

Actions:
- Combines with hydrogen ions to form carbonic acid (H_2CO_3) which breaks down into H_2O + CO_2
- Increases blood pH

Indication:
- Prolonged resuscitation not responding to hyperventilation, oxygenation, defibrillation, and first-line medications
- Tricyclic antidepressant overdose

Contraindications: Metabolic and/or respiratory alkalosis

Adverse Effects:

Metabolic
- Hypernatremia
- Metabolic alkalosis

Other
- Tissue necrosis/cellulitis with IV extravasation

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV

Onset: Immediate

Duration: Unknown (dependent upon the degree of acid-base imbalance)

Notes:
- Causes calcium chloride to precipitate and inactivates catecholamines. Flush IV tubing before and after administration.
- Adequate alveolar ventilation is the mainstay in the control of acid-base balance in cardiac arrest.

SODIUM CHLORIDE 0.9% (Normal Saline - NS)

Classification: Isotonic solution

Actions: Replacement of fluid and electrolytes lost from the intravascular and intracellular spaces

Indication:
- Initial fluid replacement for hypovolemia
- Intravenous access line for drug administration
- Infusion into saline locks to ensure patency

Contraindications: Use caution in infusing fluids to patients with rales

Adverse Effects: **Metabolic**
- Circulatory fluid volume overload

Dosage Information: Refer to VCEMS Policy 705 for specific

Route of administration: IV/IO

Onset: Immediate

Duration: Remains in intravascular space less than one hour

Notes:
- In cases of fluid resuscitation, infuse until signs of adequate perfusion.
- Use caution with fluid administration in the CHF/pulmonary edema patient. Fluid overload can worsen patient condition.
- Sodium chloride 0.9% is also used as a flush for certain medications, such as IV adenosine.