

Pharmacology in Resuscitation



Classification of Rx Modalities

Class I Indicated. Beneficial

Class IIa Indicated. Probably helpful

Class IIb Indicated. Possibly helpful

Class III Not indicated. May be harmful

Terms

Alpha=peripheral

Beta 1= Heart (1 heart)

Beta 2= Lung (2 lungs)

Chronotrope: time, alters rate of heartbeat

Inotrope: (In; think In, as in the muscle) Negative inotrope agents weaken the force of muscular contractions. Positive inotrope agents increase the strength of muscular contraction.

Parasympathomimetic (Rest and Digest) is a drug that acts by stimulating or mimicking the parasympathetic nervous system (PNS) which is sometimes called the *rest and digest* system. The PNS conserves energy as it slows the heart rate, increases intestinal and gland activity, and relaxes sphincter muscles in the gastrointestinal tract. These chemicals are also called cholinergics because acetylcholine (ACh) is the neurotransmitter used by the PNS.

Sympathomimetics (Fight or Flight) class of drugs whose effects mimic those of a stimulated sympathetic nervous system. As a result they increase cardiac output, dilate bronchioles, and usually produce constriction of blood vessels.

ET Tube is an alternative route for the administration of certain meds. (L.A.N.E) Lidocaine, Atropine, Narcan, Epinephrine. Administer 2-2.5 times the IV dose mixed with 10cc NS.

Vasopressin may be given by ET route, but at this time there is insufficient evidence to recommend a specific dose.

UNSTABLE (symptomatic): Chest pain, SOB, Change in mental status, hypotension, CHF, pulmonary edema.

INTRAVENOUS FLUIDS

Normal Saline (0.96% NaCl) is the IV of choice during resuscitation. IV's with Dextrose may exacerbate a pre-existing hyperglycemia.

PHARMACOLOGY LIST

Adenosine: Inhibits SA node discharge and slows conduction through the AV junction. Half-life is approximately 6 seconds.

Indications: PSVT, Junctional Tachycardia, Ectopic and Multifocal Atrial Tachycardia.

Dosage: 6mg. rapid IV push. If no conversion, give 12mg rapid IV push. Flush each dose with 20ml NS.

Precautions: Theophylline and xanthine derivatives block action. Persantine and Tegretol potentiate action.

Amiodarone: Is an atrial and ventricular antiarrhythmic that blocks the sodium, potassium, and calcium channels. It also has alpha- and beta-adrenergic blocking properties. Amiodarone prolongs action potential and refractory period.

Indications: Used for a variety of supraventricular and ventricular tachyarrhythmias and for rate control of rapid atrial arrhythmias in patients with impaired LV function when digoxin has proven ineffective.

Dosage for Perfusing Tachys: 150mg IV push dilute in 100mL and give over 8-10 minutes. Max dose 2.2 grams/24 hours.

Dosage VT/VF: 300mg IV/IO once, then consider additional 150mg IV/IO once.

Precautions: Do not give with Procainamide. May cause risk of Polymorphic VT, Hypotension, and may worsen existing arrhythmias or promote new ones.

Atropine: Atropine increases the discharge rate of the sinus node and improves conduction via the AV junction; blocks the parasympathetic effects on the SA node and AV junction.

Indications: First drug for symptomatic sinus bradycardia. May be beneficial in presence of AV nodal block or ventricular asystole. Second drug after epi or vasopressin for asystole or bradycardic PEA.

Dosage:

Asystole or PEA No longer indicated.

Bradycardia 0.5mg IV every 3-5 minutes not to exceed a total of 3mg (0.4mg/kg).

Acute Coronary Syndromes 0.6-1mg IV every 5 minutes not to exceed 3mg (0.4mg/kg).

Precautions: Will not be effective for Mobitz Type II block. Use with caution in presence of myocardial ischemia and hypoxia due to increased myocardial oxygen demand.

Beta-Adrenergic Blockers: Decrease rate of discharge at the SA node, decreases myocardial contractility, decreases BP, decreases myocardial oxygen consumption, decreases incidence of VF in post MI patients who did not receive thrombolytic therapy, and controls arrhythmias that are dependent on catecholamine stimulation.

Propranolol (Inderal): Non-selective Beta 1 and Beta 2 adrenergic receptor blocker. Effects myocardium (- inotrope and chronotrope) and pulmonary system (bronchoconstriction).

Atenolol (Tenormin): Beta 1 selective. AMI regimen

Esmolol (Brevibloc): Beta 1 selective. Esmolol has a short half-life (2-9 minutes).

Metoprolol (lopressor): Beta 1 selective. AMI regimen.

Indications: Reduce the incidence of recurrent ischemia, re-infarction, VT/VF, thereby reducing mortality.

Useful as an adjunct to fibrinolytic therapy. May reduce nonfatal reinfarction and recurrent ischemia. Used for emergency antihypertensive therapy for hemorrhagic and acute ischemic stroke.

Precautions: Should be avoided in bradycardia, second- and third-degree heart block, bronchospastic diseases, and cardiac failure.

Calcium Channel Blockers: Calcium channel blockers are negatively inotropic, and negatively chronotropic. They inhibit calcium ion influx in smooth muscle cells. They dilate coronary artery and arteriole vasodilatation. They reduce myocardial oxygen consumption.

Diltiazem: 0.25 mg/kg. May give second dose at 0.35 mg/kg in 15-30 minutes.

Verapamil: 2.5-5 mg IV slowly. May give second dose at 5-10 mg in 15-30 minutes.

Indications: JT, PSVT, Ectopic and Multifocal Atrial Tachycardia, Atrial Flutter, Atrial Fibrillation.

Contraindications: Hypotension, CHF, Pulmonary Edema, WPW. Not given with Beta-Blockers.

Clopidogrel: Clopidogrel is a potent oral antiplatelet agent often used in the treatment of coronary artery disease, peripheral vascular disease, and cerebrovascular disease.

Indications: Give as soon as possible to all patients with high-risk ST-segment depression or dynamic T-wave inversion in absence of contraindications. Used for antiplatelet therapy; especially for patients who cannot tolerate ASA.

Dose: 300mg PO followed by 75mg PO every day for 1 to 9 months.

Precautions: Do not administer to patients with active bleeding or patients at risk of bleeding. Use caution when administering to patients with hepatic impairment. **Do not administer in ACS if CABG planned within 5-7 days.**

Calcium Chloride: Calcium Chloride is a positive inotrope which improves myocardial contraction. It is also important in inhibiting the adverse electrophysiological effects of hyperkalemia.

Indications: Hyperkalemia, Hypocalcemia, Calcium channel blocker intoxication, Beta Blocker intoxication.

Dosage: 8-16 mg/kg of a 10% Calcium Chloride Solution.

Precaution: Do not mix with Sodium Bicarbonate.

Digibind: Digibind is an antidote for digoxin toxicity. It works by binding to digoxin and preventing it from working in the body.

Indications: Digoxin Toxicity with life threatening arrhythmias, shock, or CHF.

Dose: Varies according to amount of digoxin ingested.

Precautions: Serum digoxin levels rise after digibind therapy and should not be used to guide continuing therapy.

Digoxin: Digoxin is a positive inotrope that slows the discharge rate of the SA node, slows conduction at the AV node and junction.

Indications: To slow ventricular response in atrial fibrillation or atrial flutter. Alternative drug for reentry SVT.

Dose: Loading dose 10-15 mcg/kg. Maintenance determined by body size and renal function.

Precautions: Monitor ECG, Serum K⁺ and Digoxin levels. Reduce digoxin dose by 50% when initiating amiodorane.

Dobutamine: Dobutamine is a potent positive inotrope and a sympathomimetic which increases Cardiac Output and decreases PVR.

Indications: Used for pump problems; CHF, pulmonary congestion with systolic blood pressure of 70-100 mm Hg and no signs of shock.

Dose: IV infusion rate of 2-20 mcg/kg/min. Titrate to achieve desired affect.

Precautions: Monitor BP, ECG, UO. Observe for Tachydysrhythmias. Caution with CAD.

Dopamine: Dopamine is a potent inotrope and sympathomimetic.

Indications: Use for hypotension with signs and symptoms of shock. Second line drug for symptomatic bradycardia after atropine.

Dose: IV infusion rate of 2-20 mcg/kg/min. Titrate to patient response, and taper slowly.

Precautions: Correct hypovolemia with volume before starting dopamine. May cause tachyarrhythmia's and excessive vasoconstriction. Do not mix with Sodium Bicarbonate.

Epinephrine: Epinephrine is a sympathomimetic. It is an Alpha, Beta 1, and Beta 2 receptor stimulator.

Indications: Use for Ventricular Fibrillation, Ventricular Tachycardia, Asystole, and PEA. Epi is a catecholamine, a sympathomimetic which increases peripheral vascular resistance

Dose: 1 mg IV/IO repeat every 3-5 minutes.

Continuous Infusion: Add 1mg to 500ml NS or D5W. Initial infusion rate of 1 mcg/min titrated to effect. Typical dose 2-10 mcg/min.

Precautions: Raises blood pressure and increases heart rate. May cause myocardial ischemia, angina, and increased myocardial oxygen demand.

Fibrinolytics: Used for AMI and Acute Ischemic Stroke.

Indications: For AMI with ST elevation, new or presumably new LBBB. Time from onset of symptoms < or equal to 12 hours.

For Acute ischemic stroke Alteplase is the only fibrinolytic approved. Used in sudden onset of focal neurological deficits or alterations in consciousness. Absence of intracerebral or subarachnoid hemorrhage or mass effect on CT scan. Alteplase can be given in <3 hours from symptom onset.

Dose:

Retaplaste: AMI; two doses of 10 U IV over 2 minutes, 30 minutes apart.

Streptokinase: AMI; 0.5 to 1.0 mg/kg of body weight

Tenecteplase: AMI; bolus dose 35 to 50 mg IV

Ateplase (tPA): AMI; 15 mg IV bolus, then 0.75 mg/kg over 30 minutes with max dose 50 mg. Then give 0.5 mg/kg over the next 60 minutes with a max dose of 35mg.

Ischemic Stroke; 0.9 mg/kg infused over 60 minutes with a max dose of 90 mg. Give 10% of the total dose as an initial IV bolus over 1 minute, then give remaining 90% over next 60 minutes.

Precautions: Active internal bleeding within 21 days. History of CVA within 3 months. Major surgery or serious trauma within 14 days. Aortic dissection. Severe uncontrolled hypertension. Prolonged CPR. Lumbar Puncture within 7 days. Recent arterial puncture at noncompressible site. Do not administer aspirin or heparin with the first 24 hours of fibrinolytic therapy.

Glycoprotein IIb/IIIa Inhibitors: These drugs inhibit platelet aggregation.

Indications: Used for ACS without ST segment elevation.

Dose:

ReoPro: ACS with planned PCI within 24 hours; 0.25 mg/kg IV bolus 10 to 60 minutes prior to procedure, then 0.125 mcg/kg/min IV infusion for 12 to 24 hours. For PCI only, give 0.25 mg/kg IV bolus, then 10 mcg/min IV infusion. Precautions: Must use with heparin. Binds irreversibly with platelets. Platelet function recovery requires 48 hours. Readministration may cause hypersensitivity.

Integrillin: ACS 180 mcg/kg IV bolus over 1-2 minutes, then 2 mcg/kg/min IV infusion for 72 to 96 hours. For PCI 180 mcg/kg IV bolus over 1-2 minutes, then begin 2 mcg/kg/min IV infusion then repeat bolus in 10 minutes. Precautions: Platelet function recovers within 4-8 hours after discontinuation.

Lidocaine: Lidocaine is an antiarrhythmic drug used for Ventricular arrhythmias.

Indications: Alternate to amiodarone in cardiac arrest VF/VT. Can also be used in stable VT.

Dose: The dose for cardiac arrest is an initial dose of 1 to 1.5 mg/kg IV/IO. May give an additional 0.5 to 0.75 mg/kg IV push, repeat in 5 to 10 minutes with a max dose of 3 mg/kg.

For stable VT, doses range from 0.5 to 0.75 mg/kg up to 1 to 1.5 mg/kg. Repeat 0.5 to 0.75 mg/kg every 5 to 10 minutes with a max dose of 3mg/kg.

Precautions: CNS toxicity. If present the decrease dose and monitor closely.

Magnesium Sulfate: Magnesium is an electrolyte used in cardiac arrest with torsades de pointes present.

Indications: Used in cardiac arrest of Torsades de Pointes, hypomagnesemia, and life-threatening ventricular arrhythmias due to digitalis toxicity.

Dose:

V-fib/torsades de pointes without a pulse: 1.0-2.0 grams IV in 1-2 minutes.

Hypomagnesemia/torsades de pointes with a pulse: 1-2 grams in 50ml of 0.9% NaCl IV over 5 minutes.

Precautions: Rapid administration can cause fall in blood pressure. Use with caution if renal failure is present.

Morphine: Morphine is a narcotic analgesic with peripheral vasodilatation effects.

Indications: Chest pain not relieved with nitroglycerin in ACS, and pulmonary edema.

Dose: Titrate to pain relief with initial increments of 2-4 mg IV over 1 to 5 minutes given every 5 to 30 minutes. Repeat doses of 2-8 mg at 5 to 15-minute intervals.

Precautions: May cause hypotension and respiratory depression. Use with caution in right ventricular infarction.

Reversal: Naloxone 0.4 to 2 mg IV

Nitroglycerin: Nitroglycerin is a vasodilator.

Indications: Used for ischemic chest pain, cardiogenic pulmonary edema, and for preload and afterload reduction. Also used for hypertensive urgency in ACS.

Dose:

IV administration: IV bolus of 12.5-25 mcg, then start infusion at 10-20 mcg/min. Titrate to desired effect.

Sublingual: 1 tablet every 5 minutes for a total of 3 doses.

Aerosol Spray: 1-2 sprays for 0.5 to 1 second every 5 minutes for a total of 3 doses.

Precautions: Hypotension, tachycardia, bradycardia, syncope, reperfusion dysrhythmias, RV infarction, and headache. Ask patient if they are using medication for erectile dysfunction.

Nitroprusside: Potent peripheral vasodilator.

Indications: Used in hypertensive crisis and heart failure.

Dose: Add 50 mg in 250 ml of D5W. Begin at 0.1 mcg/kg/min and titrate every 3 to 5 minutes for desired effect. 5 mcg/kg/min is the usual max dose, but can titrate up to 10 mcg/kg/min.

Precautions: Must monitor hemodynamics. May cause hypotension, thiocyanate toxicity, and CO₂ retention.

Oxygen: Medicinal Gas.

Indications: Used for chest pain, suspected hypoxia, and cardiac arrest.

Dose:

Nasal Cannula: 1-6 L/min

Venturi Mask: 4-12 L/min

Partial Rebreather: 6-10 L/min

Nonrebreather mask with reservoir: 6-15 L/min

Precautions: Chronic CO₂ retainers (rare).

Procainamide: Ventricular and Supraventricular antiarrhythmic.

Indications: Antiarrhythmic used for recurrent VF/VT and may be used for PSVT uncontrolled by adenosine and vagal maneuvers.

Dose:

Recurrent VF/VT: 17mg/kg at 20-50 mg/min IV infusion.

Other Indications: 20mg/min IV infusion until arrhythmia suppression, hypotension, QRS widens by >50%, or a total dose of 17mg/kg is given.

Maintenance Infusion: 1-4 mg/min diluted in D5W or NS.

Precautions: In patients with renal dysfunction, reduce max total dose to 12 mg/kg and maintenance infusion to 1-2 mg/min.

Sodium Bicarbonate: Class III alkaline.

Indications: Used for hypercarbic acidosis, prolonged CPR, and hyperkalemia.

Dose: 1 mEq/kg IV bolus.

Precautions: Not recommended for routine use in cardiac arrest patients. Use arterial blood gas analysis to guide bicarbonate therapy.