

## **2015 American Heart Association Advanced Cardiac Life Support Emergency Medications**

### **Ace Inhibitors:**

\*Class: Angiotension-converting enzyme inhibitors.

\*Common Agents: Captopril, enalapril, Lisinopril, Ramipril

\*Indications: MI, especially with ST elevation and with left ventricular dysfunction

Contraindications: Lactation, pregnancy, angioedema, hypersensitivity to ACE inhibitors, hypotension.

Side Effects: Cough, dizziness, Headache, Fatigue, hypotension, hypersensitivity to ACE inhibitors.

\*Mechanisms of Action: Prevents conversion of angiotension I to II, a potent vasoconstrictor.

### **Adenosine (adenocard):**

Class: Antiarrhythmic

Indications: Regular narrow-complex tachycardia, PSVT, and wide-complex tachycardia only if regular and monomorphic.

Contraindications: Hypersensitivity, sick sinus syndrome, second- or third AV block (unless a functioning pacemakers is present), A-fib/A-flutter with underlying Wolff-Parkinson-White syndrome. Drug or poison- induced tachycardia, Bronchospastic lung disease.

Side Effects: Flushing, nausea; dizziness; headache; dypnea; bronchospasm; chest pain or tightness; discomfort in neck, jaw, throat or jaw; bradycardia; AV block; asystole; ventricular epitomic beats; VF.

Mechanisms of Action: Interrupts reentry pathways in the AV node. Slows the conduction time through the AV node restoring NSR. Half-line less than 5 seconds.

### **Adenosine Diphosphate (ADP) Antagonists:**

Class: Antiplatelet agents – thienopyridines (clopidogrel and prasugrel), cyclopentyltriazolopyrimidine (ticagrelor)

Common Agents:

Indications: Antiplatelet therapy for acute coronary syndromes (ACS) managed with percutaneous coronary intervention (PCI), Clopidogrel: ACS, recent stroke, or peripheral atrial disease.

Contraindications: Acute pathological bleeding, Prasugrel: Also history of TIA or stroke. Ticagrelor: also history of intracranial hemorrhage, hepatic impairment.

Side Effects: Bleeding, thrombocytopenia purpura. Ticagrelor: dyspnea, increased serum creatinine, stent thrombosis with premature discontinuation of therapy.

Mechanisms of Action:

### **Albuterol (ProAir, Proventil, Ventolin):**

Class: Adrenergic, beta-agonist, bronchodilator

Common Agents:

Indications: Asthma, COPD, anaphylaxis, hyperkalemia.

Contraindications: hypersensitivity, tachyarrhythmia's, risk of abortion during first or second trimester.

Side Effects: Angina, arrhythmias, palpitations, tachycardia, flushing, dizziness, headache, insomnia, irritability, angioedema, rash, urticaria, hypokalemia, hyperglycemia, asthma exacerbation, cough.

Mechanisms of Action:

### **Amiodarone (Cordarone, Pacerone):**

Class: Antiarrhythmic, class III.

Common Agents:

Indications: Management of life-threatening shock-refractory VF or VT, recurrent hemodynamically unstable VT. Conversion of A-fib, SVT. Control of rapid ventricular rate in pre-excited atrial arrhythmias.

Contraindications: hypersensitivity, Cardiogenic shock, symptomatic bradycardia or second- or third degree AV block without functioning pacemaker, severe sinus node dysfunction.

Side Effects: Vasodilation, hypotension, bradycardia, proarrhythmic effects, visual impairment, hepatotoxicity, pulmonary toxicity, CHF. May prolong QT interval, producing torsade de pointes.

Mechanisms of Action:  $\alpha$  &  $\beta$ -adrenergic blocking properties. Prolongs action potential duration. Decrease AV conduction & sinus node function

### **Aspirin (Acetylsalicylic Acid, ASA):**

Class: Antiplatelet

Common Agents:

Indications: Acute coronary syndrome, symptoms, suggestive of cardiac ischemia, post-Percutaneous Coronary interventions, A-Fib, Stroke, Peripheral arterial disease.

Contraindications: Known allergy to aspirin, third trimester of pregnancy, bleeding.

Side Effects: Anorexia, Nausea, Epigastric pain, bleeding, anaphylaxis.

Mechanisms of Action:

### **Atropine Sulfate:**

Class: Anticholinergic, parasympatholytic, vagolytic.

Common Agents:

Indications: Symptomatic sinus bradycardia, junctional escape rhythm, or second-degree type I block. Not likely to be effective in second-degree type II or third-degree AV block with wide QRS.

Contraindications: Hypersensitivity, acute angle-closure glaucoma, asthma, prostatic hypertrophy, myasthenia gravis.

Side Effects: Tachycardia, headache, dry mouth, nausea, constipation, dilated pupils, flushing, and hypotension.

Mechanisms of Action: Accelerates the HR by blocking parasympathetic nervous system.

Enhances sinus node automaticity & AV conduction. Effects of Atropine on the heart is almost entirely to its electrical activity.

### **Beta Blockers:**

Class: Beta Blockers, antihypertensive, antiarrhythmic, antianginal.

Common Agents: Atenolol, esmolol, labetalol, metoprolol, propranolol.

Indications: MI, unstable angina, PSVT, A-Fib, A-Flutter, HTN, CHF.

Contraindications: Heart rate <50bpm, systolic BP <100mm Hg, second- or third- degree AV block or sick sinus syndrome without functioning pacemaker, severe decompensated Left ventricular failure, cardiogenic shock. Nonselective beta blockers are contraindicated in bronchospastic disease.

Side Effects: Hypotension, dizziness, bradycardia, headache, fatigue, nausea and vomiting, depression.

Mechanisms of Action:  $\alpha$  – adrenergic receptor blockade. Anti-dysrhythmic

### **Calcium Chloride:**

Class: Minerals electrolytes, calcium salt.

Common Agents:

Indications: hyperkalemia, hypocalcemia, hypermagnesemia; antidote for calcium channel blocker or beta blocker overdose.

Contraindications: Hypercalcemia, hypophosphatemia, VF, digoxin toxicity.

Side Effects: Bradycardia, hypotension, hypomagnesemia, hypercalcemia, VF, syncope, nephrolithiasis, flushing, dizziness, nausea and vomiting.

Mechanisms of Action: Increases myocardial contractility and maintains cell membrane & capillary permeability

### **Digoxin (Lanoxin):**

Class: Antiarrhythmic, cardiac glycoside.

Common Agents:

Indications: To slow ventricular response in A-fib or A-flutter; rarely, as a positive inotrope in CHF

Contraindications: Hypersensitivity, uncontrolled ventricular arrhythmias, AV, block without functioning pacemaker, idiopathic hypertrophic subaortic stenosis (IHSS), constrictive pericarditis, A-fib with Wolff-Parkinson-White syndrome.

Side Effects: Accelerated junctional rhythm, atrial tachycardia with block, AV block, asystole, VT, VG, ventricular bigeminy and trigemini, dizziness, weakness, fatigue, nausea and vomiting, blurred or yellow vision, headache, hypersensitivity, hypokalemia.

Mechanisms of Action: ↓ conduction through the AV node + inotropic effect ↓ ventricular response in Afib, Aflutter, & PSVT ↑ Cardiac Output

**Digoxin Immune FAB (Fragment Antigen Binding) (DigiFab):**

Class: Antidote to digoxin and digitoxin

Common Agents:

Indications: Symptomatic digoxin toxicity or acute ingestion of unknown amount of digoxin.

Contraindications: Allergy only, otherwise none known. Allergy to sheep proteins or other sheep products.

Side Effects: Worsening of CHF, rapid ventricular response in patients with A-fib, hypokalemia, postural hypotension, increased serum digoxin levels due to bound complexes (clinically misleading because bound complex cannot interact with receptors).

Mechanisms of Action:

**Diltiazem (Cardizem):**

Class: Calcium channel blocker, antiarrhythmic, class IV.

Common Agents:

Indications: To control ventricular rate in A-fib and A-flutter; to terminate PSVT (reentry SVT) refractory to adenosine with narrow QRS complex and adequate BP.

Contraindications: Drug- or poison-induced tachycardia, wide-complex tachycardia of uncertain origin, rapid A-fib and A-flutter with Wolff-Parkinson-White syndrome, sick sinus syndrome, second- or third-degree AV block (unless a functioning pacemaker is present), hypotension with systolic BP less than 90 mm Hg, acute MI with pulmonary congestion.

Side Effects: Hypotension, bradycardia (including AV block), chest pain, ventricular arrhythmias, peripheral edema, flushing, heart failure, syncope.

Mechanisms of Action:

**Dobutamine:**

Class: Adrenergic direct-acting beta<sub>1</sub>-agonist, inotrope.

Common Agents:

Indications: To increase myocardial contractility in patients with decompensated heart failure with systolic BP 70-100 mm Hg and no signs of shock.

Contraindications: Hypersensitivity, idiopathic hypertrophic subaortic stenosis (IHSS), suspected or known poison- or drug-induced shock. Do not mix with sodium bicarbonate.

Side Effects: Tachycardia HTN, hypotension, increased ventricular ectopy, chest pain, palpitations, restlessness, headache, nausea, vomiting.

Mechanisms of Action: Has less cardiac effects than Dopamine, Strong Beta 1 Stimulant  
↑myocardial contractility – ↑Blood Pressure & ↑Renal Perfusion Slight Beta 2 (Some vasodilation ↓ ventricular afterload & ↑HR)

**Dopamine (Intropin):**

Class: Alpha-and beta<sub>1</sub>-agonist, inotrope, vasopressor.

Common Agents:

Indications: Symptomatic bradycardia and hypotension, cardiogenic shock.

Contraindications: Hypersensitivity to sulfites, pheochromocytoma, VF.

Side Effects: Tachyarrhythmias, angina, hypotension, palpitations, vasoconstriction, dyspnea, headache, nausea and vomiting.

Mechanisms of Action: 1. 5-10 mcg/kg/min Cardiac Dose ↑force of myocardial contraction & cardiac output.

### **Epinephrine (Adrenalin):**

Class: Alpha-beta adrenergic agonist (sympathomimetic: inotrope, vasopressor, bronchodilator)

Common Agents:

Indications: Cardiac arrest: PEA, asystole, pulseless VT, VF; hypotension with severe bradycardia. Anaphylaxis, severe asthma exacerbation

Contraindications: Hypersensitivity to adrenergic amines, hypovolemic shock, coronary insufficiency. No contraindication in cardiac arrest.

Side Effects: Angina, HTN, tachycardia, VT, VF, nervousness, restlessness, palpitations, tremors, weakness, diaphoresis, anxiety, headache, nausea.

Mechanisms of Action: α – adrenergic receptor – stimulating properties.

- \*Increases coronary perfusion pressures
- \*Increases myocardial & cerebral blood flow
- \*Increase in SVR – systemic Vascular Resistance (Vasoconstriction & ↑ Blood Pressure)
- \*Increases electrical activity in the myocardium
- \*Increases Automaticity

### **Fibrinolytic Agents:**

Class: thrombolytic, fibrinolytic.

Common Agents: Alteplase (Activase, t-PA), reteplase (Retavase), streptokinase (Streptase), tenecteplase (TNKase).

Indications: Acute ST elevation MI within the past 12hr. Alteplase is the only fibrinolytic agent approved for acute ischemic stroke and must be started less than 3 hr from the onset of symptoms.

Contraindications: Active internal bleeding within 21 days (except menses), neurovascular event within 3 months, major surgery or trauma within 2 weeks, aortic dissection, severe (uncontrolled) HTN, bleeding disorders, prolonged CPR, lumbar puncture within 1 week. History of any intracranial bleeding, oral anticoagulation therapy, severe stroke.

Side Effects: Hypotension, reperfusion arrhythmias, heart failure, headache, increased bleeding time, deep or superficial hemorrhage, flushing, urticaria, and anaphylaxis.

Mechanisms of Action: Activate both soluble plasminogen and surface bound plasminogen to plasmin where generated close to fibrin clot, digest fibrin and dissolves the clot.

### **Fondaparinux (Arixtra):**

Class: Factor Xa inhibitor, anticoagulant.

Common Agents:

Indications: To inhibit thrombin generation by inhibiting factor Xa in patients with ACS; anticoagulation in patients with history of heparin-induced thrombocytopenia (HIT); deep vein thrombosis (DVT) prophylaxis in patients undergoing orthopedic surgery or abdominal surgery; pulmonary embolism (PE); acute DVT without PE.

Contraindications: Creatinine clearance <30mL/min, hypersensitivity, body weight <50kg when used for prophylaxis, active major bleeding, bacterial endocarditis, thrombocytopenia associated with positive in vitro test for antiplatelet antibody in presence of fondaparinux.

Side Effects: Bleeding, edema, hypotension, insomnia, dizziness, headache, rash, constipation, vomiting, diarrhea, urinary retention, moderate thrombocytopenia.

Mechanisms of Action:

### **Furosemide (Lasix):**

Class: Loop diuretic

Common Agents:

Indications: CHF with acute pulmonary edema, hypertensive crisis, post-arrest cerebral edema, edema associated with hepatic or renal disease

Contraindications: Hypersensitivity (cross-sensitivity with thiazides and sulfonamides may occur), uncontrolled electrolyte imbalance, hepatic coma, anuria, hypovolemia

Side Effects: Severe dehydration, hypovolemia, hypotension, hypokalemia, hypotremia, hypochloremia, hyperglycemia, dizziness, ototoxicity

Mechanisms of Action:

### **Glycoprotein IIB/IIIA Inhibitors:**

Class: antiplatelet agents, GP IIB/IIIA inhibitors.

Common Agents: Abciximab (ReoPro), eptifibatide (Integrilin), tirofiban (Aggrastat).

Indications: Acute coronary syndromes managed medically (Eptifibatide and Tirofiban) and those undergoing PCI (all three agents).

Contraindications: Hypersensitivity, active internal bleeding, or bleeding disorder within past 30 days, history of bleeding diathesis, history of stroke within 30 days, history of hemorrhagic stroke, uncontrolled HTN (systolic BP>200 mm Hg, diastolic pressure > 100mm Hg), major surgery or trauma within 1 month, concomitant use of another GP IIB/IIIA inhibitor, dependency on hemodialysis.

Side Effects: Bleeding, hypotension, thrombocytopenia

Mechanisms of Action:

### **Heparin (Unfractionated Heparin [UFH]):**

Class: Anticoagulant

Common Agents:

Indications: Acute Coronary syndromes (ACS):STEMI, NSTEMI, unstable angina (UA), during PCI; prophylaxis and treatment of thromboembolic disorders such as DVT, pulmonary embolus; anticoagulant for extracorporeal.

Contraindications: Hypersensitivity, heparin-induced thrombocytopenia (HIT), severe thrombocytopenia, uncontrolled active bleeding unless due to DIC, recent intracranial, intraspinal, or eye surgery; uncontrolled HTN.

Side Effects: Bleeding, HIT, thrombocytopenia, hyperkalemia, osteoporosis with use >6 mo.

Mechanisms of Action: Anticoagulant – Accelerates formation of Antithrombin III-thrombin complex & deactivates thrombin preventing conversion of fibrinogen to fibrin

### **Ibutilide(Corvert):**

Class: Antiarrhythmic, class III

Common Agents:

Indications: SVT, including A-fib and A-flutter; most effective for conversion of A-fib or A-flutter of short duration ( $\leq 48$ hr).

Contraindications: Known hypersensitivity, history of polymorphic VT, QTc greater than 440msec.

Side Effects: Non-sustained or sustained monomorphic or polymorphic VT, torsade de pointes, AV block, CHF, HTN, headache, tachycardia, hypotension, nausea and vomiting.

Mechanisms of Action: Decrease the heart rate and AV conduction by activating a slow inward NA Current.

### **Isoproterenol (Isuprel):**

Class: Beta-adrenergic agonist

Common Agents:

Indications: Medically refractory symptomatic bradycardia when transcutaneous or transvenous pacing is not available, refractory torsade de pointes unresponsive to magnesium, bradycardia in heart transplant patients, beta blocker poisoning

Contraindications: Hypersensitivity to drug or sulfites, digitalis, intoxication, angina, tachyarrhythmias, concurrent use with epinephrine (can cause VF or VT)

Side Effects: Arrhythmias, cardiac arrest, hypotension, angina, anxiety, tachycardia, palpitations, skin flushing, dizziness, tremors, headache, nausea, vomiting, restlessness.

Mechanisms of Action:

### **Lidocaine (Xylocaine):**

Class: Antiarrhythmic, class Ib, local anesthetic

Common Agents:

Indications: Alternative to amiodarone in VF or pulseless VT. Use in stable VT, wide-complex tachycardia of uncertain origin.

Contraindications: Prophylactic use in acute MI, advanced AV block without functioning pacemaker, hypotension, Wolff-Parkinson-White syndrome, hypersensitivity to amide local anesthetics.

Side Effects: Confusion, agitation, anxiety, tinnitus, blurred vision, dizziness, tremors, hallucinations, seizures, hypotension, bradycardia, cardiovascular collapse, respiratory arrest, slurred speech.

Mechanisms of Action: Shortens the refractory period (QT Interval) and suppresses automaticity.  
↓ irritability.

**Magnesium Sulfate:**

Class: Electrolyte, antiarrhythmic

Common Agents:

Indications: Torsade de pointes, hypomagnesemia, life-threatening ventricular arrhythmias due to digitalis toxicity, status asthmaticus seizures.

Contraindications: Hypermagnesemia, hypocalcemia, AV block.

Side Effects: HTN, bradycardia, cardiac arrest, respiratory depression, altered LOC, flushed skin, diaphoresis, hypocalcemia, hyperkalemia, hypophosphatemia.

Mechanisms of Action: Plays important role in neurotransmission and muscular excitability.

**Morphine Sulfate:**

Class: Opiate narcotic analgesic

Common Agents:

Indications: Chest pain unrelieved by nitroglycerin; CHF and dyspnea associated with pulmonary edema.

Contraindications: Hypersensitivity, heart failure due to chronic lung disease, respiratory depression, hypercarbia, hypotension, bowel obstruction, severe asthma, acute or severe hypercarbia. Avoid in patients with RV infarction.

Side Effects: Respiratory depression, hypotension, nausea and vomiting, bradycardia, altered LOC, seizures, somnolence, dizziness, diaphoresis, flushing, pruritus, dry mouth, urinary retention.

Mechanisms of Action: Causes Vasodilation which reduces myocardial oxygen consumption. Analgesia, Sedation

**Naloxone (Narcan):**

Class: Opioid antagonist

Common Agents:

Indications: Reversal of opioid overdose/toxicity unresponsive to oxygen and ventilator support, such as respiratory and neurological depression.

Contraindications: Hypersensitivity, meperidine-induced seizures.

Side Effects: Secondary to reversal (withdrawal) of narcotic analgesia and sedation. Recurrent respiratory depression, pain, hypertension, hypotension, irritability, agitation, diaphoresis, seizures.

Mechanisms of Action:

**Nitroglycerin (Nitrostat, Nitrolingual [Pump spray]):**

Class: Antianginal, nitrate, vasodilator.

Common Agents:

Indications: Acute coronary syndrome, angina, CHF associated with acute MI, hypertensive urgency with ACS.

Contraindications: Hypersensitivity, systolic BP less than 90 mm Hg, pericardial tamponade, constrictive pericarditis, severe bradycardia or severe tachycardia associated with hypotension;



sildenafil (Viagra) or vardenafil (Levitra) within 24 hr, tadalafil (Cialis) within 48 hr; right ventricular infarction, increased intracranial pressure, hypertrophic cardiomyopathy with outflow tract obstruction, restrictive cardiomyopathy, increased intracranial pressure.

Side Effects: Hypotension with reflex tachycardia, syncope, headache, flushed skin, dizziness, paradoxical bradycardia.

Mechanisms of Action: Smooth muscle relaxant. Reduces cardiac workload (preload). Dilates coronary arteries. Dilates systemic arteries (May reduce BP and relieve pain in AMI)

### **Norepinephrine (Levophed):**

Class: Alpha- and beta-adrenergic agonist, vasopressor

Common Agents:

Indications: Treatment of persistent shock after adequate volume replacement, cardiogenic shock, low systemic vascular resistance shock, septic shock, hemodynamically significant hypotension.

Contraindications: Hypovolemic shock prior to adequate volume replacement, mesenteric or peripheral vascular thrombosis except as emergency measure to maintain coronary and cerebral perfusion. Do not administer in same line as alkaline solutions.

Side Effects: Arrhythmias, hypertension, headache, anxiety, dyspnea, skin necrosis with extravasation.

Mechanisms of Action: Dominant Alpha Activity, Potent Vasoconstrictor renal & mesenteric.

### **Oxygen:**

Class: Gas

Common Agents:

Indications: Cardiopulmonary emergencies with shortness of breath and chest pain, cardiac or respiratory arrest, hypoxemia. Used to optimize oxygen saturation <94%.

Contraindications: None reported.

Side Effects: Drying of respiratory mucosa, possible bronchospasm if oxygen is extremely cold and dry. Oxygen supports combustion and can fuel a fire. Hypoventilation in patients with severe COPD, pulmonary fibrosis, oxygen toxicity.

Mechanisms of Action: Improves tissue oxygenation and hemoglobin saturation when circulation is maintained.

### **Procainamide (Pronestyl):**

Class: Antiarrhythmic, class Ia.

Common Agents:

Indications: Recurrent VT or VF, PSVT refractory to adenosine and vagal stimulation, rapid A-fib with Wolff-Parkinson-White syndrome, stable wide-complex tachycardia of uncertain origin, maintenance after conversion. Stable monomorphic VT with normal QT<sub>c</sub> and preserved LV function.

Contraindications: Hypersensitivity, second- and third-degree AV block (unless a functioning pacemaker is in place), prolonged QT interval torsade de pointes, hypersensitivity, systemic

lupus erythematosus.

Side Effects: Hypotension, widening QRS, headache, nausea and vomiting, flushed skin, seizures, ventricular arrhythmias, AV block, cardiovascular collapse, arrest.

Mechanisms of Action: Reduces the automaticity of all pacemakers. Slows intra-ventricular conduction. Suppresses Ventricular ectopy.

### **Sodium Bicarbonate:**

Class: Alkalinizing agent, buffer

Common Agents:

Indications: Known preexisting hyperkalemia, bicarbonate-responsive acidosis such as diabetic ketoacidosis or tricyclic antidepressant overdose, metabolic acidosis associated with prolonged resuscitation with effective ventilation.

Contraindications: Metabolic and respiratory alkalosis, hypochloremia, hypocalcemia, hypokalemia, hypercarbic acidosis, hypernatremia, severe pulmonary edema.

Side Effects: Hypokalemia, hypocalcemia, hypernatremia, metabolic alkalosis, edema, seizures, tetany, exacerbation of CHF, tissue hypoxia, intracellular acidosis.

Mechanisms of Action: Reverses acidosis

### **Vasopressin (Pitressin):**

Class: Vasopressor, hormone.

Common Agents:

Indications: Cardiac arrest: an alternative to epinephrine in shock-refractory VF and pulseless VT, PEA, and asystole. Vasodilatory shock/septic shock.

Contraindications: Hypersensitivity

Side Effects: Bradycardia, HTM, angina, MI, arrhythmias, dizziness, headache, nausea and vomiting, abdominal cramps, diaphoresis, bronchoconstriction, anaphylaxis.

Mechanisms of Action: In unnaturally high doses it acts as a non-adrenergic peripheral vasoconstrictor.

### **Verapamil (Calan, Isoptin):**

Class: Calcium channel blocker, antiarrhythmic, class IV, antihypertensive.

Common Agents:

Indications: PSVT (with narrow QRS and adequate BP) refractory to adenosine; rapid ventricular rates in A-fib, A-flutter, and MAT.

Contraindications: A-fib with Wolff-Parkinson-White syndrome, wide complex tachycardia of uncertain origin, second- or third-degree AV block (unless a functioning pacemaker is in place), sick sinus syndrome, hypotension, severe CHF, cardiogenic shock, concurrent IV beta blocker, VT.

Side Effects: Hypotension, exacerbation of CHF with left ventricular dysfunction, bradycardia, AV block, constipation, peripheral edema, headache, dizziness, fatigue, paralytic ileus, hepatotoxicity.

Mechanisms of Action: