

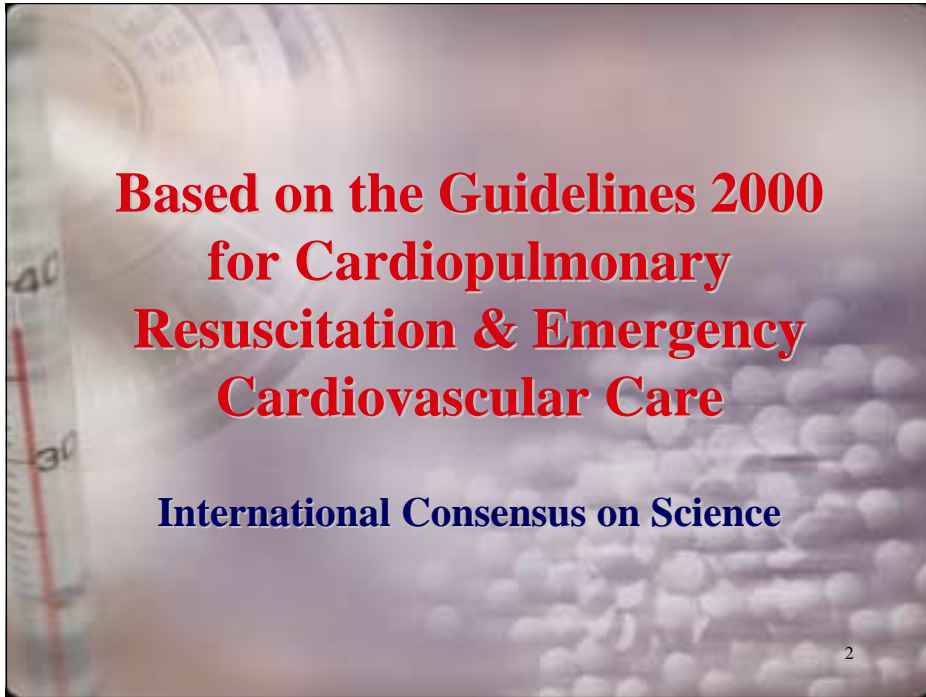


# EMERGENCY PHARMACOLOGY I & II

Advanced Cardiac Life Support

Seminole Community College

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# Based on the Guidelines 2000 for Cardiopulmonary Resuscitation & Emergency Cardiovascular Care

International Consensus on Science

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## Pharmacology I

### Antiarrhythmic Drugs

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## ADENOSINE (Adenocard)

- **Mechanism of Action** - Adenosine is a endogenous purine nucleoside that depresses AV node and sinus node activity.
- Since most common forms of **PSVT** involve a reentry pathway including the AV node, Adenosine is effective in terminating these arrhythmias.

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## ADENOSINE (Adenocard)

- **Mechanism of Action** cont.- if arrhythmia does not involve a reentry pathway including Atrial Fibrillation or Flutter, Atrial or Ventricular Tachycardias, Adenosine will not be effective in terminating these arrhythmias.
- If this is the case **Adenosine** may cause AV or Ventricular blocks.

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## ADENOSINE (Adenocard)

- **INDICATIONS** - Used in the treatment of Paroxysmal Supraventricular Tachycardia (PSVT) including PSVT in WPW syndrome.

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## ADENOSINE (Adenocard)

- **PRECAUTIONS:** Adenosine produces a short lived pharmacologic response because it is rapidly metabolized by enzymatic degradation in the blood and tissues.
- The **half-life** is approximately 5 seconds or less.

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## ADENOSINE (Adenocard)

- **PRECAUTIONS:** Side effects are common but usually short lived; Flushing, dyspnea, chest pain and transient sinus bradycardia and ventricular ectopy after termination of PSVT.
- **Should not** be used diagnostically for stable, wide complex tachycardias of unknown type (**this is a new guideline**).

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## ADENOSINE (Adenocard)

- **DOSAGE** - **6 mg** rapid bolus over 1-3 seconds. Followed by 20 ml flush. A brief period of Asystole (up to 15 seconds) may occur after rapid administration.
- After 1-2 minutes give **12 mg**, may repeat a second **12 mg** after 1 - 2 minutes. IV should be in antecubital fossa. **92% conversion usually after the first 12 mg dose.**

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## Amiodarone Hydrochloride (Cordarone)

- **Mechanisms of Action:** effects on sodium, potassium, and calcium channels, also with alpha and beta blocking properties.
- Lengthens the cardiac action potential (antisympathetic action). **Negative dromotropic** effects on SA node and AV node.
- It has vasodilatory effects that decrease cardiac workload and myocardial oxygen consumption.

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## Amiodarone Hydrochloride (Cordarone)

- **Indications:** preferred treatment for atrial and ventricular arrhythmias. Used prior to Lidocaine.
- **Treatment and prophylaxis** of frequently recurring ventricular fibrillation and hemodynamically unstable ventricular tachycardia in patients refractory to other agents.
- Ventricular rate control of rapid **atrial arrhythmias** in patients with severely impaired left ventricular function when digitalis is ineffective.

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## Amiodarone Hydrochloride (Cordarone)

- **Indications:** ventricular rate control due to accessory pathway conduction in preexcited atrial arrhythmias.
- **Adjunct to electrical cardioversion** of refractory PSVT's and atrial tachycardia.

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## Amiodarone Hydrochloride (Cordarone)

- **Effective for the control** of hemodynamically stable VT, polymorphic VT, and wide-complex tachycardia of uncertain origin.
- **Used after** defibrillation and epinephrine in cardiac arrest due to persistent VF or VT.

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## Amiodarone Hydrochloride (Cordarone)

- **Contraindications:** hypersensitivity, cardiogenic shock, sinus bradycardia, 2<sup>nd</sup> or 3<sup>rd</sup> degree block.
- **Hypotension most common side effect.**
- **Treatment with fluid and temporary pacing can correct hypotension due to Amiodarone in the field!**

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## Amiodarone Hydrochloride (Cordarone)

- **Dosage:** in cardiac arrest due to pulseless VT or VF **300 mg** rapid infusion diluted in 20 to 30 ml of saline or D<sup>5</sup>W. Followed by 150 mg every 3-5 mins until arrhythmia is suppressed.
- **Arrhythmias with a pulse:** **150 mg** over ten minutes followed by 1mg/min infusion for 6 hours. Repeat **150 mg** if necessary to a maximum daily (24 hrs) dose of 2.2 grams.
- **Maintenance infusion:** **0.5 mg/min** maximum daily dose of 2.2 grams.

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## Amiodarone Hydrochloride (Cordarone)

- **Administration difficulties:**
  - Contained in an ampule must use filtered needle to draw up.
  - Must be drawn up slowly because bubbles will occur if drawn rapidly (soap-like solution).
  - Must be given rapidly and only once.
  - Many side effects.
  - 150 mg/ampule, must draw up two ampules.
  - Expensive approximately \$175.00 per 300 mg dose.

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## ATROPINE SULFATE

- **Mechanism of Action:** Parasympatholytic drug which enhances both sinus node automaticity, and AV node conduction by reversing cholinergic-mediated affects. Inhibits the release of acetylcholine from the vagus nerve.

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## ATROPINE SULFATE

- **Indications:** Ventricular Asystole, Conduction disturbances (Symptomatic 1<sup>st</sup> or 2<sup>nd</sup> degree type 1 AV blocks), Symptomatic bradycardia, slow pulseless electrical activity.

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## ATROPINE

- **Precautions:**
  - Tachydysrhythmias.
  - Increased myocardial oxygen consumption
  - Use with caution in the presence of acute myocardial ischemia associated with acute myocardial infarction.
  - Do not push slowly as paradoxical bradycardia may occur.
  - Less than 0.5 mg can cause a further slowing of the rate.

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## ATROPINE

- **Precautions:** do not use when bradycardia from AV block at the His-Purkinje level Mobitz (type) II or 3<sup>rd</sup> degree (complete) heart block with new wide-QRS complexes is suspected.
- **Atropine can rarely accelerate sinus rate and AV node conduction.**

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## ATROPINE

- **Dosage:**
  - Asystole & Slow PEA **1 mg IVP** and repeated every 3-5 mins if asystole persists.
  - Bradycardia & AV Blocks **0.5 mg - 1.0 mg** every 3 - 5 mins.
  - ET administration: **2.0 - 2.5 mg** diluted in 10 ml NS.
  - Maximum dose: **3 mg (0.04 mg/kg)** complete vagolytic dose.
  - Less than **0.5 mg** causes paradoxical bradycardia.
- **Maximum dose should be reserved for asystolic cardiac arrest only, this is due to the increase in myocardial oxygen demand!**

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## PROPRANOLOL, METOPROLOL, ATENOLOL, ESMOLOL

- **Mechanism of Action** - Beta blocking agents attenuate the effects of circulating catecholamines by blocking their ability to bind to beta receptors.
- **Reduces** heart rate, blood pressure, myocardial contractility and therefore myocardial oxygen consumption.  
*Decreases (depresses) the pumping function of the heart.*

22

## PROPRANOLOL, METOPROLOL, ATENOLOL, ESMOLOL

- **Mechanism of Action** – benefits in patients with acute coronary syndromes, including patients with non-Q wave MI and unstable angina.
- Therefore **beta blockers** should be administered in these patients under these conditions!

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## PROPRANOLOL, METOPROLOL, ATENOLOL, ESMOLOL

- **Indications** - Primary indication is to control recurrent ventricular tachycardia ventricular fibrillation and supraventricular arrhythmias.
- **Precautions:** Hypotension, Congestive heart failure and bronchospasm.
- **Dosage** - Varies with desired effect.  
Currently not used in the field!

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## BRETYLIUM TOSYLATE (Bretylol)

- **Indications** – no longer indicated for treatment of ventricular arrhythmias, due to the decrease in availability and it's documented ineffectiveness.
- **Has been removed from all algorithms.**

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## VERAPAMIL & DILTIAZEM (Calan - Isoptin, Cardizem)

- **Mechanism of Action** - Both are calcium channel blocking agents that slow conduction and increase refractoriness in the AV node. These actions terminate reentrant arrhythmias that require AV nodal conduction.

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## VERAPAMIL & DILTIAZEM (Calan - Isoptin, Cardizem)

- **Verapamil** is a **negative inotropic** agent that causes a reduction in myocardial oxygen requirement. May also control ventricular response in A-Fib, A-Flutter, or multifocal Atrial Tachycardia.

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## VERAPAMIL & DILTIAZEM (Calan - Isoptin, Cardizem)

- **Indications** - Used in the treatment of Paroxysmal Supraventricular Tachycardia (PSVT) narrow complex and ventricular rate control in Atrial Fibrillation. However, **Adenosine** is the drug of choice.

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## VERAPAMIL & DILTIAZEM (Calan - Isoptin, Cardizem)

- **Precautions** - Possible hemodynamic compromise. Should not be used in WPW syndrome or impaired heart function.
- **Calcium** is used for possible overdose of Verapamil or other Calcium channel blocker.

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## VERAPAMIL & DILTIAZEM (Calan, Isoptin, Cardizem)

- **Dosage:**
  - Verapamil:** 2.5 - 5.0 mg IV over 2 minutes. Repeat doses of 5 - 10 mg every 15 to 30 minutes to a maximum of 30 mg.
  - Diltiazem:** 0.25 mg/kg over 2 minutes followed by 0.35 mg/kg. Produces less myocardial depression than Verapamil.

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## DISOPYRAMIDE

- **Mechanism of Action:** antiarrhythmic agent that acts to slow conduction velocity, and prolongs the effective refractory period (similar to Procainamide).
- Potent anticholinergic, negative inotropic, and hypotensive effects.
- **Not used in the field!**

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## FLECAINIDE

- **Mechanism of Action:** potent sodium channel blocker with significant conduction-slowing effects.
- **Indications:** ventricular arrhythmias and for patients in supraventricular arrhythmias with structural heart disease. IV version (not approved in U.S.) has corrected A-fib, Ectopic A-tachycardia, A-flutter.
- **Precautions:** must be administered slowly, bradycardia, hypotension, and neurological abnormalities.

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## IBUTILIDE

- **Mechanism of Action:** short-acting antiarrhythmic drug. Effective by prolonging the action potential duration and increasing the refractory period of cardiac tissue.
- **Indications:** acute pharmacologic conversion of Atrial flutter or A-Fib when electrical cardioversion has failed.

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## IBUTILIDE

- **Dosage:** Adults over 60 kg, IV 1 mg/10 ml over 10 minutes. Repeat if unsuccessful 1mg/10ml over 10 minutes.
- If under 60 kg administer 0.01 mg/kg and repeat in second dose.
- **Precautions:** minimal effects on the heart rate and BP. However. May cause ventricular proarrhythmias especially when there is an impaired LV.

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## ISOPROTERENOL(Isuprel)

- **Mechanism of Action** - Isoproterenol is a pure beta adrenergic agent. Potent inotropic and chronotropic agent that increases cardiac output and **myocardial oxygen demand**.  
Isoproterenol **can increase** myocardial ischemia and exacerbates arrhythmias.

35

## ISOPROTERENOL(Isuprel)

- **Indications** - Refractory torsades de pointes (**Chemical overdrive pacing**) and immediate control of hemodynamically significant bradycardia especially in the denervated hearts of heart transplant patients. However, *not the treatment of choice, used until a pacemaker, atropine, dobutamine is available and has failed.*

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## ISOPROTERENOL (Isuprel)

- **Precautions** - ventricular ectopy and dysrhythmias. Electronic pacing preferred!
- **Dosage** - 2 to 10 mcg/min titrated to effect. 1 mg/250 ml fluid infusion.

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## LIDOCAINE (Xylocaine)

- **Mechanism of Action** - Suppresses ventricular arrhythmias by decreasing the automaticity of phase 4 depolarization. Depresses conduction in reentrant pathways. Elevates fibrillation threshold. Decreases excitability of ischemic tissue.

38

## LIDOCAINE

- **Indications:** Used in the treatment of:
  - VF/ Pulseless VT that persists after defibrillation and epinephrine (Class Indeterminate).
  - Control of hemodynamically compromising PVC's (Class Indeterminate).
  - Hemodynamically stable VT (Class IIb)
- **Lidocaine is the second choice medication** behind other alternate agents: Amiodarone, Procainamide, Sotalol)

39

## LIDOCAINE

- **Precautions** - Routine prophylactic administration is no longer recommended in uncomplicated acute MI or ischemia without PVC's.
- **Toxic - therapeutic balance is delicate.**

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## LIDOCAINE

- **Dosage** – In cardiac Arrest
- **Initial dose of 1.0 - 1.5 mg/Kg**
- **Additional boluses of 0.5 - .75 mg/Kg repeat in 3 - 5 minutes; maximum total dose of 3 mg/Kg.**
- **The more aggressive dosing approach is recommended in cardiac arrest (1.5mg/kg).**

41

## LIDOCAINE

- **Dosage** – In V-Tach with a pulse or other ventricular ectopic beats **0.5 – 0.75 mg/Kg, 3 mg/Kg maximum dose.**
- **Infusion: 2-4 mg/min**
- **Mix 1 Gm in 250 ml NS or 2 Gm in 500 ml.**

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## LIDOCAINE

- **In Patients older than 70 years old, and in those with Hepatic dysfunction should receive the initial normal loading dose.**
- **The maintenance infusion should be reduced by 50%.**
- **Infusion rate of 1 - 4 mg/minute (class indeterminate).**

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## LIDOCAINE

- **Special Considerations:**
- **Endotracheal Dose: 2 – 4 mg/kg**
- **Reappearance of arrhythmias during a constant infusion of Lidocaine should be treated with a small bolus dose (0.5 mg/kg).**

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## LIDOCAINE

- **Toxic reactions and Side effects:**
  - Slurred speech
  - Altered consciousness
  - Muscle twitching
  - Seizures
  - Bradycardia

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## MAGNESIUM SULFATE

- **Mechanism of Action -**  
Magnesium deficiency is associated with cardiac arrhythmias, symptoms of cardiac insufficiency, and sudden cardiac arrest.
- **Hypomagnesemia** can precipitate refractory V-Fib.

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## MAGNESIUM SULFATE

- **Indications** - Used in the treatment of Ventricular Fibrillation / Ventricular Tachycardia after full doses of Amiodarone and Lidocaine have failed to convert rhythm. Treatment of choice for Torsades de pointes.

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## MAGNESIUM SULFATE

- **Should only be used** when arrhythmias may be caused by Magnesium deficiency or Torsades de Pointes.
- **Dosage** - 1 to 2 grams loading dose mixed in 10 ml of solution and administered over 1 to 2 minutes.

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## PROCAINAMIDE (Pronestyl)

- **Mechanism of Action** – **supresses both atrial and ventricular arrhythmias**. Acceptable for the pharmacological conversion of supraventricular arrhythmias (particularly A Fib and A Flutter) to sinus rhythm (class IIa).

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## PROCAINAMIDE (Pronestyl)

- **Supresses ventricular ectopy** similar to Lidocaine. Recommended when Amiodarone and Lidocaine is contraindicated or it has failed to suppress ventricular ectopy.

50

## PROCAINAMIDE (Pronestyl)

- **Increases ventricular fibrillation threshold**. Shortens effective refractory period of the AV node, lengthens refractory period in bundle of his.

51

## PROCAINAMIDE (Pronestyl)

- **Indications** - Secondary to Amiodarone and Lidocaine in the field. Used when both medications have failed to suppress the life threatening ventricular arrhythmias. Suppresses PVC's and recurrent V-tach, V-fib.

52

## PROCAINAMIDE (Pronestyl)

- **Precautions** - Contraindicated in Torsades de Pointes, hypotension after rapid injection. Adverse ECG effects. Use caution in acute MI.

53

## PROCAINAMIDE (Pronestyl)

- **DOSAGE** - Infusion of 30 mg/min until one of the following is observed:
  - 1. Arrhythmia is suppressed
  - 2. Hypotension ensues
  - 3. QRS widens by 50%
  - 4. Total of 17 mg/kg administered (1.2 gm/70kg)
- **Maintenance Infusion rate: 1 – 4 mg/minute**

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## PROPRAFENONE

- **Mechanism of Action:** Antiarrhythmic agent with significant conduction-slowing and negative inotropic effects with additional non-selective beta blocking properties.
- **Used in U.S. orally** only for treatment of supraventricular and ventricular arrhythmias in patients without structural heart disease.

55

## PROPRAFENONE

- **Indications:** ventricular arrhythmias and for patients in supraventricular arrhythmias with structural heart disease. IV version (not approved in U.S.) has corrected A-fib, Ectopic A-tachycardia, A-flutter.
- **Dosage:** No field dose

56

## SOTALOL

- **Mechanism of Action:** prolongs action potential duration like Amiodarone, and increases cardiac tissue refractoryness.
- **Used in U.S. orally** only for treatment of supraventricular and ventricular arrhythmias in patients without structural heart disease.
- **Dosage:** No field dose

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## Pharmacology II

### Agents to Optimize Cardiac Output and Blood Pressure

58

## EPINEPHRINE (Adrenolin)

- **Mechanisms of Action:** Naturally occurring catecholamine with both Alpha and Beta adrenergic properties (Sympathomimetic agent).
- **Greatest benefit** from alpha adrenergic stimulating properties.

59

## EPINEPHRINE (Adrenolin)

- **Mechanisms of Action:**
  - Increases myocardial and cerebral blood flow during CPR
  - Increased systemic vascular resistance
  - Increased arterial blood pressure
  - Increased heart rate (**Chronotropic** effects)
  - Increased myocardial contraction (**Inotropic** effect). Increased automaticity
  - **Increased myocardial oxygen requirement**

60

## EPINEPHRINE (Adrenolin)

- **Indications:** “First Agent in All Forms of Cardiac Arrest”
  - Improves V-Fib conversion, PEA, May restore electrical activity in Asystole.
  - Vasopressor agent for symptomatic bradycardia (not first line drug).
- **Vasopressin** may be substituted in the V-fib algorithm.

61

## EPINEPHRINE (Adrenolin)

- **Precautions:** May precipitate or exacerbate myocardial ischemia. Do not mix with alkaline solutions. Ventricular ectopy in digitalized patients.
- Remember the increase in **Myocardial Oxygen Demand!**

62

## EPINEPHRINE (Adrenolin)

- **Dosage:**
  - 1 mg of 1: 10,000 solution IVP every 3-5 minutes followed by 20 ml flush.
  - **ET administration:** 2 - 2.5 mg in 10 ml.
  - **Infusion:** 1 mg in 250 ml, dose 1 mcg/min.

63

## VASOPRESSIN

- **Mechanism of Action:** naturally occurring antidiuretic hormone that acts as a non-adrenergic peripheral vasoconstrictor.
- **Indications:** May be substituted for Epinephrine in the V-fib / V-tach without a pulse algorithm (class IIb).

64



## VASOPRESSIN

- **Mechanism of Action:** during a short duration of V-Fib, during CPR increased coronary perfusion pressure, and vital organ blood flow.
- **Vasopressin** does not increase myocardial oxygen demand because of the lack of beta adrenergic stimulation.
- **Vasopressin** remains intact during acidosis.

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## VASOPRESSIN

- **Half-life 10 – 20 minutes**
- **Dosage: 40 U (units) IVP**
- May follow up with Epinephrine after 10 – 20 minutes of initial administration.
- **May later be used for PEA and Asystole.**
- **Inexpensive to purchase and easy to administer.**

66

## NOREPINEPHRINE (Levophed)

- **Mechanism of Action** - Naturally occurring catecholamine that is a potent alpha receptor agonist and vasoconstrictor. Causes a great increase in **myocardial oxygen demand** and will exacerbate myocardial ischemia.

67

## NOREPINEPHRINE (Levophed)

- **Indications** – (None in the field)  
Treatment for hemodynamically significant hypotension that is refractory to other sympathomimetic amines.  
**Should be considered as a last and temporary measure.**

68

## NOREPINEPHRINE (Levophed)

- **Precautions** - Increases myocardial oxygen requirement and will exacerbate ischemia. **If drug infiltrates** 5 to 10 mg of Phentolamine should also be infiltrated to prevent tissue necrosis and sloughing.
- **Dosage** - 0.5 - 1.0 mcg/minute titrated to effect. 4 mg placed in 250 ml D<sup>5</sup>W.

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## DOPAMINE (Intropin)

- **Mechanism of Action** - A chemical precursor of norepinephrine that has both alpha and beta actions, and stimulates dopaminergic receptors in a dose dependant fashion.
- **Dopamine** stimulates the heart through beta receptors.

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## DOPAMINE (Intropin)

- **Indications:** usually reserved for hypotension that occurs with symptomatic bradycardia or post cardiac arrest. **Goal BP 90 mm Hg.**
- **Precautions:** dose dependant, higher doses may have a profound negative impact on the heart. **Do not use** in the same IV lines as Bicarbonate, may inactivate. **Extreme tissue destruction if IV infiltrates.**

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## DOPAMINE (Intropin)

- **Other Precautions** - SVT or ventricular arrhythmias. MAO inhibitors may potentiate the effects of dopamine, use 1/10th the normal dose. Alkaline solutions inactivate dopamine. Must be tapered off, use central line due to risk of infiltration causing severe damage.

72

## DOPAMINE (Intropin)

- **Dosage:** in low doses **1-2 mcg/Kg/min** produces vasodilation of renal, mesenteric, and cerebral arteries by stimulation **dopaminergic receptors**.
- At midrange doses **2 - 10 mcg/Kg/min** produces cardiovascular effects (Beta).

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## DOPAMINE (Intropin)

- At higher doses **20 mcg/Kg/min** produce hemodynamic effects similar to norepinephrine (peripheral arterial vasoconstriction).

74

## DOPAMINE

- **Field Dosage -**  
5 mcg/Kg/min titrated to effect. Final recommended dose dosage range is 5 - 20 mcg/kg/min.

**Dopaminergic effect:** 1 – 2 mcg/kg

**Beta effect:** 2 – 10 mcg/kg

**Alpha effect:** 10 – 20 mcg/kg

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## DOBUTAMINE (Dobutrex)

- **Mechanism of Action -** synthetic sympathomimetic amine that exerts its potent inotropic effects by stimulating beta-1 and alpha adrenergic receptors in the myocardium and blood vessels.
- Dobutamine has beneficial hemodynamic effects and its lack of norepinephrine release minimize its effects on myocardial oxygen demand. **DOES NOT PRODUCE RENAL AND MESENTERIC VASODILATION LIKE DOPAMINE.**

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## DOBUTAMINE (Dobutrex)

- **Indications** - Treatment of pulmonary congestion and severe systolic heart failure.
- **Precautions** - High doses may cause myocardial ischemia, SVT and V-tach.
- **Dosage** - 2 to 20 mcg/Kg/min.

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## AMRINONE (Inacor) & MILRINONE

- **Mechanism of Action** - Rapid-acting inotropic agent whose net effects are similar to dobutamine. Cardiac output increases and peripheral vascular resistance and preload are diminished.
- **Indications** - Severe congestive heart failure refractory to diuretics or cardiogenic shock.

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## AMRINONE (Inacor) & MILRINONE

- **Precautions** - May induce or worsen myocardial ischemia, and ventricular ectopy.
- **Dosage** - 0.75 mg/Kg every 2 - 3 minutes followed by 5 to 15 mcg/Kg/min infusion.

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## CALCIUM CHLORIDE

- **Mechanism of Action** - Although Calcium ions play a critical role in myocardial contractile performance and impulse formation, however **studies have not shown benefit** from the use of calcium and in fact may be detrimental.

80

## CALCIUM CHLORIDE

- **Indications** - Hyperkalemia, Hypocalcemia and channel blocker toxicity (verapamil) class IIb.
- **Dosage** - 2 mg - 4 mg/Kg repeat if necessary in 10 minute intervals.

81

## DIGITALIS

- **Mechanism of Action** - Rapid-acting inotropic agent who net effects are similar to dobutamine.
- Cardiac output increases and peripheral vascular resistance and preload are diminished.
- **Extremely limited use in Emergency Cardiac Care.**

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## DIGITALIS

- **Indications** – decreases ventricular rate in Atrial flutter and Atrial fibrillation. No longer preferred method.
- **Precautions** - May induce or worsen myocardial ischemia, and ventricular ectopy (all lethal forms of dysrhythmias have occurred).
- **Dosage** - 10 - 15 mcq/Kg every 2 - 3 minutes followed by 5 to 15 mcq/Kg/min infusion.

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## NITROGLYCERINE

- **Mechanism of Action** - Organic nitrate that relaxes vascular smooth muscle
- **Indications** - Primary indication is to relieve Angina Pectoris, initial treatment of choice for ischemic-type pain or chest discomfort.
- **Parenteral choice** for the treatment of congestive heart failure, management of uncomplicated MI.

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## NITROGLYCERINE

- **Precautions:** Hypotension, Headache.
- **Dosage** - 0.3 mg - 0.4 mg every 3 - 5 minute intervals if discomfort is not relieved.
- **Infusion** - 50 or 100 mg / 250 ml, rate 10 to 20 mcg/min increased by 5 – 10 mcg every 5 - 10 mins until desired clinical response.

85

## SODIUM NITROPRUSSIDE

- **Mechanism of Action** - Sodium Nitroprusside is a potent peripheral vasodilator, effects are seen immediately and cease within minutes after infusion is discontinued.

86

## SODIUM NITROPRUSSIDE

- **Indications** - Parenteral treatment of choice for **severe heart failure and hypertensive emergencies** when immediate reduction of peripheral resistance is necessary.
- **Nitroglycerine** is preferred because it is less likely to lower coronary perfusion pressure, and likely to increase perfusion to the myocardium.

87

## SODIUM NITROPRUSSIDE

- **Precautions** - Hypotension is the most common adverse reaction seen with nitroprusside. Hypotension may precipitate myocardial ischemia, infarction or stroke.
- **Dosage** - 0.1 to 5 mcg/Kg/min titrated to effect. Mix 50 - 100 mg/250 ml D5W.

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## SODIUM BICARBONATE

- **Mechanism of Action** - Sodium Bicarbonate reacts with the hydrogen ions in the blood to form carbon dioxide and water to buffer metabolic acidosis.

89

## SODIUM BICARBONATE

- **Indications** - Used during cardiac resuscitation only after defibrillation, effective CPR, Endotracheal intubation, hyperventilation with 100% oxygen and more than one dose of epinephrine.
- May be used with the following **preexisting conditions: metabolic acidosis, hyperkalemia, or tricyclic or phenobarbital overdose.**

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## SODIUM BICARBONATE

- **Precautions** - The major problem is that  $\text{NaHCO}_3$  has a high carbon dioxide content, the  $\text{CO}_2$  crosses rapidly into the cells causing an increase in intracellular hypercarbia and acidosis especially in myocardial and cerebral cells. Bicarbonate crosses much more slowly.
- **Other problems include:** Hyponatremia and a shift in the oxyhemoglobin saturation curve preventing  $\text{O}_2$  release to the tissues. Metabolic Alkalosis. Do not mix with catecholamines.

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## SODIUM BICARBONATE

- **Dosage** - 1 mEq/Kg initially, 0.5 mEq/Kg dose every 10 minutes thereafter.
- Should be guided by blood gases if possible. Use after the first ten minutes in cardiac arrest, however not recommended by the AHA.

92

## DIURETICS (Furosemide)

- **Mechanism of Action** - Rapidly acting potent diuretic that inhibits the reabsorption of sodium in the renal loop of henle. Has a **direct venodilating** effect in patients with pulmonary edema onset approximately 5 minutes. Diuresis occurs later.

93

## DIURETICS (Furosemide)

- **Indications** - Treatment of pulmonary edema associated with left ventricular failure.
- **Precautions** - Dehydration, hypotension, electrolyte depletion in coronary heart disease.
- **Dosage:** 0.5 - 1.0 mg/Kg initially IV slowly over 1 - 2 minutes.

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## MORPHINE

- **Mechanism of Action** - Narcotic analgesic - manifests analgesic and hemodynamic effects, increasing venous capacitance and reduces systemic vascular resistance, reduces preload, relieving pulmonary congestion. Reduces intramyocardial wall tension, which **decreases myocardial oxygen requirements**. Reduces anxiety.

95

## MORPHINE

- **Indications** - Drug of choice in treatment of pain and anxiety associated with AMI and in the Treatment of acute pulmonary edema.
- **Precautions** - Respiratory depression, hypotension. Overdose can be corrected with IV Naloxone (**Narcan**) 0.4 -0.8 mg.

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## MORPHINE

- **Dosage** - 1 mg - 3 mg IV slowly over 1 to 5 minutes until the desired effect is achieved.

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## THROMBOLYTIC AGENTS (Anistreplase, Streptokinase, Alteplase)

- **Mechanism of Actions** - Activate both soluble plasminogen and surface bound plasminogen to plasmin. Pharmacologic thrombolysis occurs when surface-bound plasminogen is converted to surface bound plasmin which digests fibrin and dissolves the clot.

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## THROMBOLYTIC AGENTS (Anistreplase, Streptokinase, Alteplase)

- **Indications** - *Should be initiated immediate after the onset of chest pain (within 6-12 hours, ideally within 6 hours).*
- **Precautions** - Bleeding is the major complication as a result of thrombolytic therapy. Various contraindications for this type of therapy.
- **Dosage** - Varies with type of drug used.
- **New Fibrolytic Agents now used: Ativase.**

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## SYMPTOMATIC BRADYCARDIA

- *Remember the following sequence:*

*1st line - Atropine (except high block)*  
*2nd line - Pacemaker*  
*3rd line - Dopamine*  
*4th line - Epinephrine*

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## The End

- This Microsoft PowerPoint presentation was prepared by **Rob Holborn Ed.D, EMT-P, Seminole Community College.**
- The presentation was prepared by using the textbook: **Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care: International Consensus on Science and the 1998 National EMT-Paramedic Curriculum**