

Cardiovascular Pharmacology
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Learning Objectives

- ^ Identify the actions, effects, indications, adverse effects and precaution for agents from the following drug categories:
 - f cardiotoxic agents
 - f antidysrhythmic agents
 - f nitrates
 - f miscellaneous agents

Cardiotonic Agents

Epinephrine

- ^ **Actions**
 - ◆ alpha1- vasoconstriction
 - ◆ beta1
 - ◆ chronotropic- heart rate
 - ◆ inotropic- contractility
 - ◆ dromotropic- conductivity
 - ◆ beta2- smooth muscle relaxation
 - ◆ bronchodilation
 - ◆ vasodilation

Epinephrine

- ^ **Effects:**
 - ◆ increase systemic vascular resistance (SVR) blood pressure (BP), peripheral blood flow
 - ◆ increase coronary and cerebral blood flow
 - ◆ increase myocardial electrical activity
==> increased automaticity ==> increased HR
 - ◆ increase myocardial contractility
 - ◆ increase myocardial O₂ requirements

Epinephrine

- ^ **Indications**
 - f resuscitation
 - f shock, including anaphylaxis
 - f severe asthma

Epinephrine

^Routes

- f Intravenous (IV)
- f Subcutaneous (SC)
- f Endotracheal tube (ETT)- double IV dosage

Epinephrine

^Adverse effects

- f Hypertension
- f Myocardial infarction
- f Tachycardia
- f Peripheral tissue blood flow impairment (ischemia)

Norepinephrine (Levophed)

^Actions- alpha, beta1 adrenergic

^Effects

- f increased SVR ==> increased BP
- f increased HR
- f positive inotropic

Norepinephrine (Levophed)

^Indication- neurogenic or septic shock

^Adverse effects

- f Myocardial hypoxia ==> infarction
- f renal failure
- f Hypertension
- f Necrosis of exposed tissues
- f Peripheral ischemia

Dopamine

^Actions- alpha1, beta1 adrenergic, dopaminergic

^Effects (dose-dependent)

- f Low dose- Cerebral, renal, mesenteric vasodilation
- f Moderate doses- increase cardiac output
- f High dose- generalized vasoconstriction

Dopamine

^Indications:

- f hypotension (shock)
- f decreased urinary output

Dopamine

- ^ Adverse effects
 - f Tachycardia
 - f Renal necrosis
 - f Peripheral tissue necrosis
 - f dysrhythmias

Vasopressin (Pitressin)

- ^ Synthetic endogenous hormone-antidiuretic hormone
- ^ Effects
 - f anti-diuresis
 - f vasoconstriction
 - f stimulation of ACTH release

Link to information on vasopressin
<http://www.cvphysiology.com/Blood%20Pressure/BP016.htm>

Vasopressin (Pitressin)

- ^ Indications
 - f cardiac arrest
 - f shock
 - ◆ septic
 - ◆ hypovolemic
 - f diabetes insipidus- accompanies head trauma

Link to vasopressin in acute care
<http://www.acutecare.com/vasop.htm>

Neosynephrine (Phenylephrine)

- ^ Action- alpha adrenergic
- ^ Effect- potent vasoconstrictor
- ^ Indications:
 - f non-hypovolemic shock
 - f mucosal edema- post-extubation??
 - f mucosal bleeding
 - f prolong action of local anesthetics
- ^ Adverse effects- tissue ischemia

Dobutamine

- ^ Actions- alpha, beta1, beta2 adrenergic
- ^ Effects:
 - f positive inotropic ==> increased cardiac output
 - f Mild peripheral vasodilation ==> decreased PVR, SVR, increased coronary perfusion
 - f Does NOT increase myocardial O₂
 - f Combined with dopamine ==> maintain BP, without increasing PAP

Dobutamine

- ^ Indications
 - f Acute congestive heart failure (CHF)
 - f right ventricular failure

Milrinone (Primacor)

- ^ Action- phosphodiesterase inhibitor
- ^ Effects
 - f inotropic
 - f vasodilation

Link to milrinone
<http://milrinone.com/>

Milrinone (Primacor)

- ^ Indications
 - f cardiomyopathy
 - f congestive heart failure
 - f pulmonary arterial hypertension (PAH)

Link to aerosolized milrinone for PAH
<http://www.cja-jca.org/cgi/content/full/52/10/1076>

Digitalis glycoside- digoxin

- ^ Action- increased Ca++ in myocardium
- ^ Effects
 - f positive inotropic
 - f negative dromotropic ==> depresses AV conduction

Digitalis glycoside- digoxin

- ^ Indication
 - f specific dysrhythmias
 - f Chronic CHF

Digitalis glycoside- digoxin

- ^ Adverse effects- digitoxicity more likely with hypokalemia
 - f Multiple types of dysrhythmias
 - f Agitation
 - f Nausea & vomiting

Antidysrhythmic Agents

Atropine

- ^ Action- parasympatholytic
- ^ Effects (cardiac)
 - f increased SA node automaticity
 - ==> increased HR
 - f increased AV node conductivity

Atropine

- ^ Indications
 - f Bradycardia
 - f Heart block
 - f Asystole- may be worth a try
- ^ Routes
 - f IV
 - f instillation through ETT
- ^ Side effects- tachycardia

Lidocaine

- ^ Action- sodium channel blocker
- ^ Effects
 - f decreased automaticity
 - f decreased conductivity
 - f increased threshold for fibrillation
- ^ Indications- rapid ventricular dysrhythmias

Lidocaine

- ^ Routes
 - f ETT administration ==> double dose
 - f IV
- ^ Adverse effects
 - f Psychoses, seizures
 - f decreased contractility
 - f Heart block- asystole
 - f increased threshold for defibrillation
 - f Lethal if given for heart block with escape beats

Amiodarone (Cordarone)

- ^ Action- multiple ion channel blocker
- ^ Effects
 - f decreased AV conduction
 - f decreased sinus node function
- ^ Indications- dysrhythmias
- ^ Adverse effects (circulatory):
 - f hypotension
 - f bradycardia

Amiodarone (Cordarone)

- ^ Adverse effects (pulmonary)- occurs over days-years of treatment
 - f pulmonary oxygen toxicity
 - f interstitial pneumonitis
 - f pulmonary infiltrates
 - f organizing pneumonia ± bronchiolitis obliterans (BOOP)
 - f pulmonary fibrosis

Link to amiodarone toxicity (requires free registration)
http://www.medscape.com/viewarticle/418090_4

Amiodarone (Cordarone)

- ^ Adverse effects (pulmonary):
 - f A-C membrane permeability edema with or without ARDS
 - f alveolar hemorrhage
 - f bronchospasm
 - f laryngeal edema
 - f anaphylactic shock
 - f pleural effusion
 - f pleural/pericardial thickening

Beta adrenergic blockers

- ^ Action- beta1 blockade
- ^ Effects
 - f decreased HR
 - f decreased vascular resistance
 - f decreased contractility
 - f decreased conductivity
 - f decreased myocardial O₂ consumption

Beta adrenergic blockers

- ^ Indications
 - f angina
 - f hypertension
 - f Post-MI
 - f Inhibit ventricular response to atrial flutter, fibrillation

Beta adrenergic blockers

- ^ Side effects
 - f Hypotension
 - f CHF
 - f Bronchospasm- non-selective agents

Beta adrenergic blockers

- ^ Agents
 - f propranolol (non-selective)
 - f atenolol
 - f metoprolol
 - f sotalol (Betapace)- non-selective
 - f esmolol- short duration of action
 - f nadolol (Corgard)- non-selective
 - f sotalol (Betapace)

Calcium Channel Blockers

- ^ action- block entry of Ca⁺⁺ to myocardium
- ^ indications
 - f angina
 - f dysrhythmias; e.g., PSVT
 - f hypertension

Calcium Channel Blockers

^agents

- f* verapamil (Calan, Isoptan)
- f* diltiazem (Cardizem)
- f* amlodipine (Norvasc)

Magnesium Sulfate

^Action- replacement for depletion of Mg⁺⁺

- f* malnourishment
- f* alcoholism

^Effects

- f* reverses torsades des pointes
- f* relaxes bronchial smooth muscle
- f* relaxes uterine muscle

Magnesium Sulfate

^Indications:

- f* hypomagnesemia
 - f* torsades des points VT
 - f* status asthmaticus
 - f* pre-eclampsia/eclampsia
- ^Adverse effects- minimal

Nitrates

Sodium nitroprusside (Nipride)

^Effects- vasodilation, arterial and venous

^Indications

- f* Hypertensive emergency
- f* LV failure

Sodium nitroprusside (Nipride)

^Adverse effects

- f* cyanide poisoning
 - f* hypotension
- ^Precaution- avoid exposure of agent to light

Nitroglycerine

- ^Effect- decreased SVR ==> decreased afterload and preload
- ^Side effects- hypotension, headache
- ^Indication- angina pectoris, AMI
- ^Preparations- sublingual tablets, IV, patches

Miscellaneous Agents

Nesiritide (Natrecor)

- ^synthetic recombinant brain natriuretic peptide (BNP)
 - f potent vasodilator
 - f rapid reduction in PCWP
- ^FDA approval in 2001
- ^indication
 - f severe decompensated CHF
 - f dyspnea at rest or minimal activity

Link to nesiritide
<http://www.natrecor.com/natrecor/resources.html>

Nesiritide (Natrecor)

- ^Contraindications
 - f low filling pressures
 - f hypotension
- ^Adverse effects
 - f kidney failure
 - f death
 - f litigation

Angiotensin converting enzyme (ACE) inhibitors

- ^action- block conversion of angiotensin I to angiotensin II
- ^effect- vasodilation
- ^indications
 - f hypertension
 - f heart failure
- ^side effect- chronic, dry cough

Link to information on ACE inhibitors
<http://www.chfpatients.com/ace.htm>

Angiotensin converting enzyme (ACE) inhibitors

- ^side effects
 - f chronic, dry cough
 - f angioedema- airway obstruction

Link to information on ACE inhibitors
<http://www.chfpatients.com/ace.htm>

ACE inhibitors

^agents

f lisinopril (Zestril), (Prinivil)

f ramipril (Altace)

f enalapril (Vasotec)

f benazepril (Lotensin)

f captopril (Capoten)