

Chapter-7 | P. Chemistry

Drugs Acting on Cardiovascular System

In Syllabus:

Study of the following category of medicinal compounds with respect to classification, chemical name (IUPAC Name), chemical structure (compounds marked with*) uses, stability and storage conditions, different types of formulations and their popular brand names:

Drugs Acting on Cardiovascular System

- Anti-Arrhythmic Drugs: Quinidine Sulphate, Procainamide Hydrochloride, Verapamil, Phenytoin Sodium*, Lidocaine Hydrochloride, Lorcaïnide Hydrochloride, Amiodarone and Sotalol
- Anti-Hypertensive Agents: Propranolol*, Captopril*, Ramipril, Methyldopate Hydrochloride, Clonidine Hydrochloride, Hydralazine Hydrochloride, Nifedipine,
- Antianginal Agents: Isosorbide Dinitrate

Drugs Acting on Cardiovascular System:

- Drugs acting on the cardiovascular system are a group of medications that are used to treat a variety of heart and blood vessel conditions. These drugs work by affecting the heart rate, blood pressure, and blood flow.
- There are many different types of drugs acting on the cardiovascular system, each with its own specific mechanism of action.

Some of the most common types of these drugs include:

- **Antihypertensives:** These drugs lower blood pressure. They work by relaxing blood vessels, making it easier for blood to flow through them.
- **Antiarrhythmics:** These drugs help to regulate the heartbeat. They work by blocking the electrical signals that control the heart's rhythm.
- **Antianginal agents:** These are drugs used to treat angina pectoris, a chest pain caused by reduced blood flow to the heart.



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Anti-arrhythmic drugs:

- Anti-arrhythmic drugs are medications used to treat abnormal heart rhythms, also known as arrhythmias. Arrhythmias can be caused by a variety of factors, including heart disease, medications, and electrolyte imbalances.

Classification of anti-arrhythmic drugs:

There are four main classes of anti-arrhythmic drugs:

- **Class I drugs** slow down the electrical impulses in the heart. They work by blocking sodium channels in the heart muscle. Examples of class I drugs include quinidine, procainamide, and disopyramide.
- **Class II drugs** are beta blockers. They work by blocking the effects of adrenaline, a hormone that can increase heart rate and blood pressure. Examples of class II drugs include propranolol, atenolol, and metoprolol.
- **Class III drugs** prolong the electrical impulses in the heart. They work by blocking potassium channels in the heart muscle. Examples of class III drugs include amiodarone, sotalol, and dofetilide.
- **Class IV drugs** are calcium channel blockers. They work by blocking the movement of calcium into cells, which relaxes the smooth muscles in the walls of blood vessels. This widens the vessels and improves blood flow to the heart. Examples of class IV drugs include diltiazem and verapamil.

Example:

- Quinidine Sulphate
- Procainamide Hydrochloride
- Verapamil, Phenytoin Sodium*
- Lidocaine Hydrochloride
- Lorcainide Hydrochloride
- Amiodarone and Sotalol

Note (Rough):



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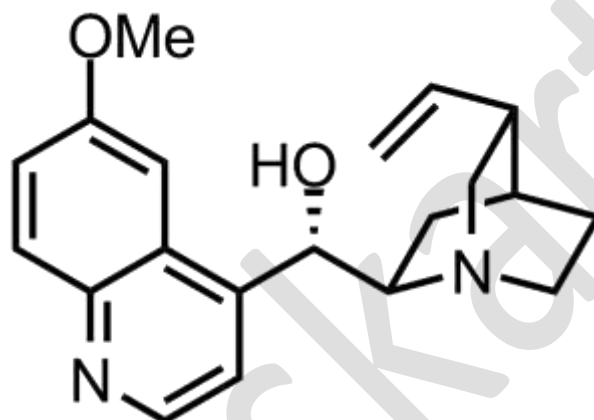
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Quinidine Sulphate:

- **Quinidine** is a class I antiarrhythmic agent used to treat heart rhythm disturbances.
- It is a diastereomer of antimalarial agent quinine, originally derived from the bark of the cinchona tree.
- Quinidine primarily works by blocking the fast inward sodium current (INa). Quinidine's effect on INa is known as a 'use dependent block'.

Chemical Name: (S)-(6-Methoxyquinolin-4-yl)[(1S,2R,4S,5R)-5-vinylquinuclidin-2-yl]methanol

Chemical Structure:



Uses:

- This medication is used to treat or prevent many types of irregular heartbeats (heart arrhythmias such as atrial fibrillation).
- Quinidine can greatly improve your ability to perform normal activities by decreasing the number of irregular heartbeats you have.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablets
- Capsule

Popular brand names:

- Natcardine
- Natcardine
- Quinidex



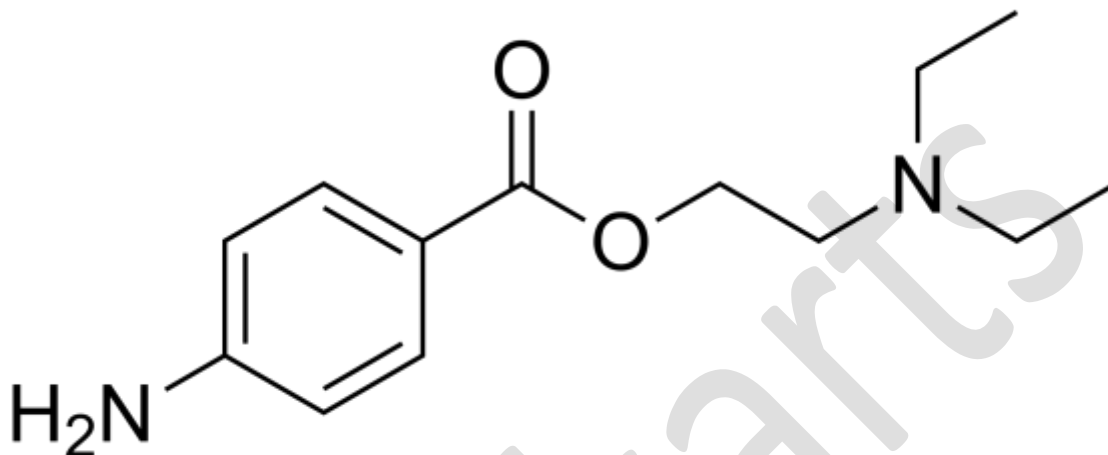
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Procainamide Hydrochloride

Chemical Name: 2-(diethylamino)ethyl 4-aminobenzoate

Chemical Structure:



Uses:

- It is mainly used for infiltration anesthesia, peripheral nerve block, and spinal block.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Injection
- Tablet

Popular brand names:

- Procanbid
- Pronestyl

Note:



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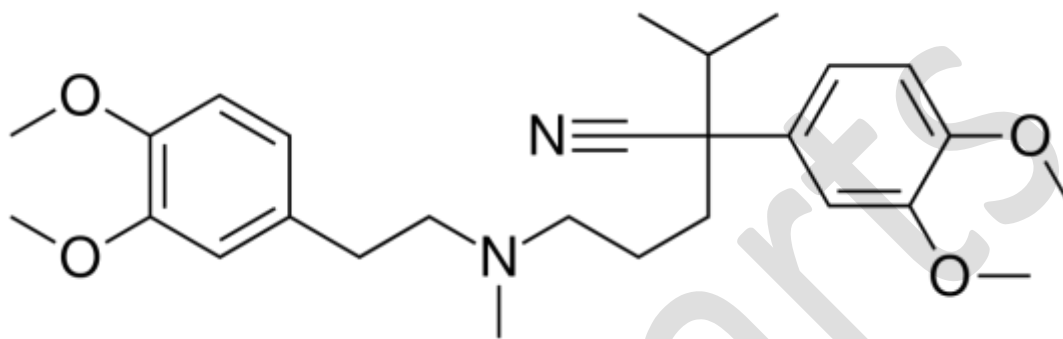
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Verapamil

Chemical Name:

(RS)-2-(3,4-Dimethoxyphenyl)-5-{{2-(3,4-dimethoxyphenyl)ethyl}(methyl)amino}-2-(propan-2-yl)pentanenitrile

Chemical Structure:



Uses:

- Verapamil is used to prevent chest pain caused by angina as well as irregular heart rhythms (arrhythmias).
- It's also used to treat high blood pressure (hypertension).
- If you have high blood pressure, taking verapamil helps to prevent: future heart disease.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet

Popular brand names:

- Verelan PM
- Verelan

Note:



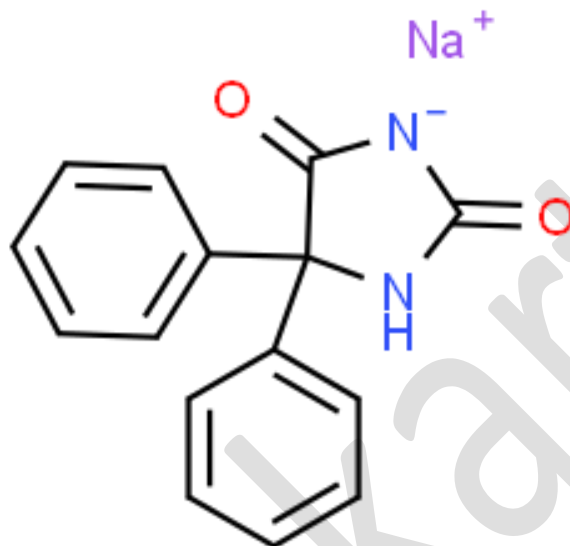
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Phenytoin Sodium*

Chemical Name: sodium 5,5-diphenyl-2, 4-imidazolidinedione

Chemical Structure:



Uses:

- Phenytoin is a medication used in the management and treatment of epilepsy, generalized tonic-clonic seizures, complex partial seizures, and status epilepticus.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet

Popular brand names:

- Epanutin,
- Epanutin Infatabs

Note:



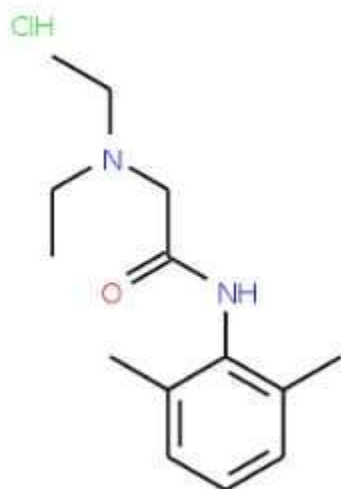
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Lidocaine Hydrochloride

Chemical Name: Lignocaine, Xylocaine, 2-(Diethylamino)-N-(2,6-dimethylphenyl)acetamide

Chemical Structure:



Uses:

- Lidocaine jelly is also used to relieve pain caused by swelling of the urinary tract (urethritis). It works by numbing certain areas of the body that are moist.
- It is used to prevent and to treat pain from some procedures.
- This medicine is also used to treat minor burns, scrapes and insect bites.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet
- Capsule
- Jelly

Popular brand names:

- Xylocaine



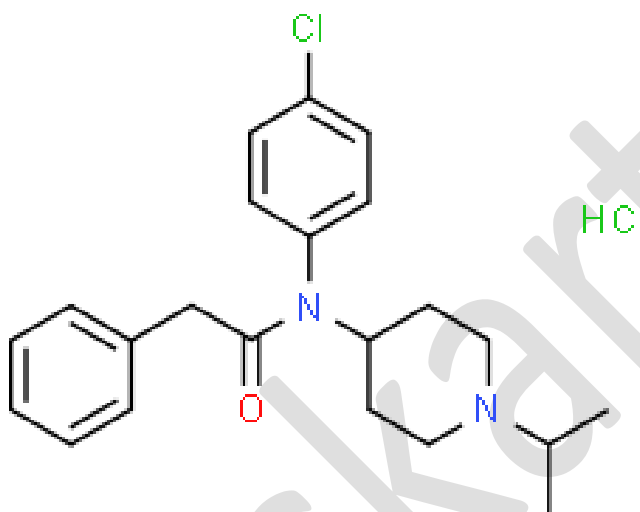
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Lorcainide Hydrochloride

Chemical Name: N-(4-chlorophenyl)-N-(1-isopropylpiperidin-4-yl)-2-phenylacetamide

Chemical Structure:



Uses:

- Lorcainide hydrochloride is a class Ic antiarrhythmic agent that is used to help restore normal heart rhythm and conduction in patients with premature ventricular contractions, ventricular tachycardia and Wolff–Parkinson–White syndrome.
- It is also used to prevent recurrent ventricular fibrillation.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet
- Capsule

Popular brand names:

- Remivox



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Amiodarone

Chemical Name: (2-butyl-1-benzofuran-3-yl)-[4-[2-(diethylamino)ethoxy]-3,5-diiodophenyl]methanone

Uses:

- Amiodarone is used to treat and prevent certain types of serious, life-threatening ventricular arrhythmias (a certain type of abnormal heart rhythm when other medications did not help or could not be tolerated).

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet

Popular brand names:

- Pacerone

Sotalol

Chemical Name: (RS)-N-{4-[1-hydroxy-2-(propan-2-ylamino)ethyl]phenyl}methanesulfonamide

Uses:

- It's used to treat atrial fibrillation and other conditions that cause an irregular heartbeat (arrhythmia).
- This medication is used to treat a serious (possibly life-threatening) type of fast heartbeat called sustained ventricular tachycardia.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablet

Popular brand names:

- Betapace
- Sorine



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Anti-Hypertensive Agents:

- Antihypertensive agents are a class of drugs that are used to treat hypertension, also known as high blood pressure.
- Hypertension is a major risk factor for heart disease, stroke, kidney disease, and other health problems. Antihypertensive agents work by different mechanisms to lower blood pressure.

Classification of Anti-Hypertensive Agents:

Some of the most common types of antihypertensive agents include:

- **Diuretics:** Hydrochlorothiazide, furosemide, lisinopril
- **Beta-blockers:** Atenolol, metoprolol, propranolol
- **Calcium channel blockers:** Amlodipine, diltiazem, verapamil
- **ACE inhibitors:** Captopril, lisinopril, ramipril
- **ARBs:** Candesartan, losartan, valsartan

Example:

- Propranolol*
- Captopril*
- Ramipril
- Methyldopate Hydrochloride
- Clonidine Hydrochloride
- Hydralazine Hydrochloride
- Nifedipine

Note:



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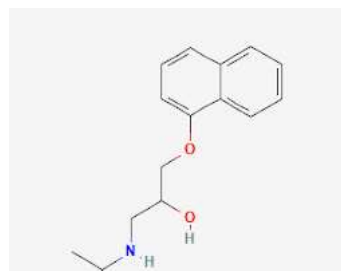
Propranolol*

- Propranolol is a beta-adrenergic receptor antagonist.

Chemical Name:

- Its chemical name is 1-(1-isopropylamino)-3-(1-naphthoxy)-2-propanol.

Chemical Structure:



Uses:

Propranolol is used to treat a variety of conditions, including:

- High blood pressure (hypertension)
- Angina (chest pain)
- Arrhythmias (irregular heartbeats)
- Hyperthyroidism (overactive thyroid)
- Proliferating infantile hemangioma (a type of birthmark)

Stability and Storage Conditions: Propranolol is stable at room temperature. It should be stored in a cool, dry place, away from direct sunlight.

Types of Formulations: Propranolol is available in a variety of formulations, including:

- Tablets
- Capsules
- Extended-release tablets
- Oral solution
- Injection

Popular Brand Names:

- Inderal
- Inderal LA
- Avlocardyl



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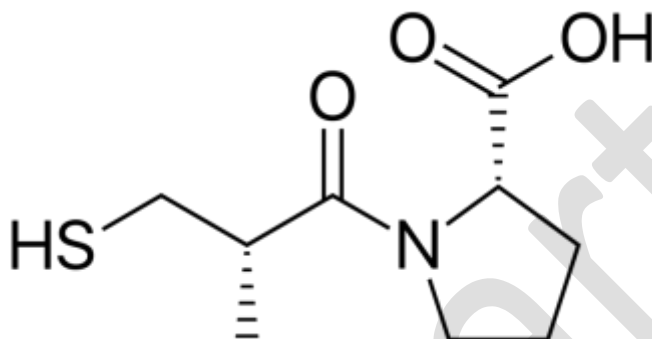
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Captopril*

- Captopril is a L-proline derivative in which L-proline is substituted on nitrogen with a (2S)-2-methyl-3-sulfanylpropanoyl group.

Chemical Name: (2S)-1-[(2S)-2-methyl-3-sulfanylpropanoyl]pyrrolidine-2-carboxylic acid.

Chemical Structure:



Uses:

- Captopril is an angiotensin-converting enzyme (ACE) inhibitor.
- ACE inhibitors work by blocking the production of a hormone called angiotensin II.
- Angiotensin II is a powerful vasoconstrictor, which means that it causes blood vessels to narrow.
- By blocking the production of angiotensin II, captopril helps to relax blood vessels and lower blood pressure.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- **Tablets**
- **Capsules**
- **Oral solution**
- **Intravenous solution**

Popular brand names:

- Capoten
- Capozide
- Aceon
- Accupril



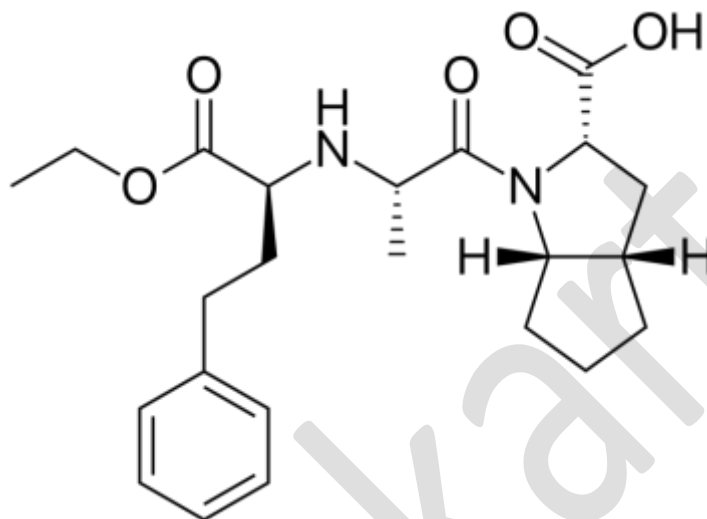
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Ramipril,

Chemical Name: (2S,3aS,6aS)-1[(S)-N [(S)-1-Carboxy-3-phenylpropyl] alanyl] octa hydrocyclopenta [b]pyrrole-2-carboxylic acid, 1 ethyl ester

Chemical Structure:



Uses:

- Ramipril is a medicine widely used to treat high blood pressure (hypertension) and heart failure.
- It's also prescribed after a heart attack.
- Ramipril helps prevent future strokes, heart attacks and kidney problems.
- It also improves your survival if you're taking it for heart failure or after a heart attack.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablets,
- Capsules,
- Injectables

Popular brand names:

- Altace
- Prinivil
- Zestril



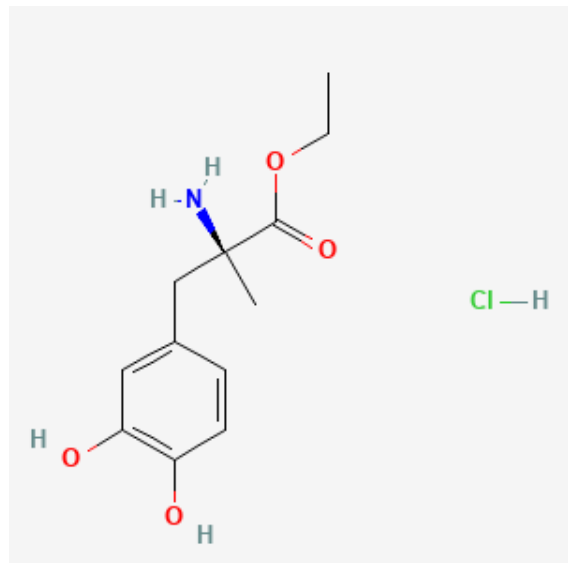
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Methyldopate Hydrochloride,

Chemical Name: [levo-3-(3,4-dihydroxyphenyl)-2-methylalanine, ethyl ester hydrochloride]

Chemical Structure:



Uses:

- Methyldopate hydrochloride is used to treat high blood pressure. It is also used to treat some cases of Parkinson's disease.

Stability and storage conditions:

- Methyldopate hydrochloride is stable at room temperature. It should be stored in a cool, dry place.

Types of formulations:

- Tablet
- Capsule

Popular brand names:

- Aldomet
- Dopar
- Parcopa



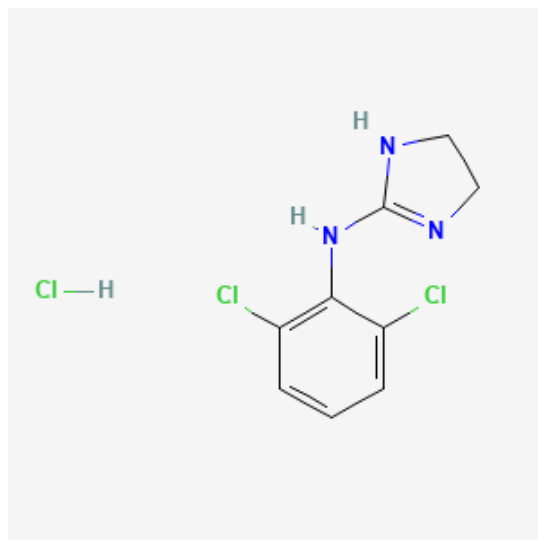
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Clonidine Hydrochloride,

Chemical Name: N-(2,6-dichlorophenyl)-4,5-dihydro-1H-imidazol-2-amine;hydrochloride

Chemical Structure:



Uses:

- Clonidine hydrochloride is a medication used to treat high blood pressure, attention deficit hyperactivity disorder (ADHD), drug withdrawal (alcohol, opioids, or smoking), menopausal flushing, diarrhea, spasticity, and certain pain conditions.
- It is used by mouth, by injection, or as a skin patch. Onset of action is typically within an hour with the effects on blood pressure lasting for up to eight hours.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablets,
- Capsules,
- Liquid,
- Patches, and injectable solution.

Popular brand names:

- Catapres
- Kapvay
- Duraclon



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Hydralazine Hydrochloride

Chemical Name: phthalazin-1-ylhydrazine;hydrochloride

Uses:

- Hydralazine hydrochloride is a medication used to treat high blood pressure (hypertension).
- It is also used to control high blood pressure in a mother during pregnancy (pre-eclampsia or eclampsia) or in emergency situations when blood pressure is extremely high (hypertensive crisis).

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablets
- Capsules, and injectable form.

Popular brand names:

- Apresoline
- Hydrex
- Unipril

Nifedipine

Chemical Name: 3,5-dimethyl 2,6-dimethyl-4-(2-nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate

Uses:

- Nifedipine is a calcium channel blocker that is used to treat high blood pressure (hypertension), angina (chest pain), and preterm labor.
- It is also sometimes used to treat Raynaud's phenomenon, a condition that causes blood vessels in the fingers and toes to narrow, making them cold and numb.

Stability and storage conditions:

- It should be kept in a cool, dry place and stored at room temperature. Direct sunlight is prohibited.

Types of formulations:

- Tablets
- Capsules
- Transdermal patch

Popular brand names:

- Adalat



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Antianginal Agents: Isosorbide Dinitrate

Antianginal agents are a class of drugs used to treat angina, a condition that causes chest pain due to a lack of oxygen to the heart.

Classification of Antianginal agents:

There are three main classes of antianginal agents:

- **Nitrates** work by relaxing the blood vessels, which increases blood flow to the heart. Examples of nitrates include nitroglycerin, isosorbide dinitrate, and isosorbide mononitrate.
- **Beta blockers** slow down the heart rate and reduce the force of heart contractions, which decreases the heart's demand for oxygen. Examples of beta blockers include atenolol, metoprolol, and propranolol.
- **Calcium channel blockers** relax the muscles in the walls of the blood vessels, which also increases blood flow to the heart. Examples of calcium channel blockers include diltiazem, nifedipine, and verapamil.

Isosorbide Dinitrate

Chemical Name:

1,4-Dioxane-3,5-diyl dinitrate

Uses:

- Isosorbide dinitrate is a prescription medication used to treat angina pectoris (chest pain).
- It works by relaxing the blood vessels, which increases blood flow to the heart.

Stability and storage condition:

- It should be stored in a closed container at room temperature, away from heat, moisture, and direct light. Keep from freezing.

Types of formulations:

- Tablets
- Capsules
- Sublingual

Popular brand names:

- Dilatrate-SR
- Isordil
- Isordil Titradoso
- ISDN

