International Journal of Chemistry Studies
ISSN: 2581-348X; Impact Factor: RJIF 5.44
Received: 01-02-2019; Accepted: 02-03-2019
www.chemistryjournal.in
Volume 3; Issue 3; May 2019; Page No. 01-05

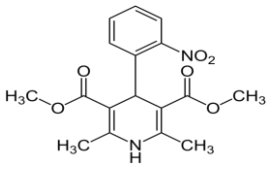
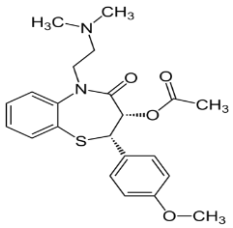
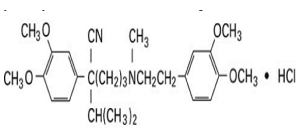
List of nitrogen containing heterocyclic compounds useful in the treatment of cardiovascular drugs

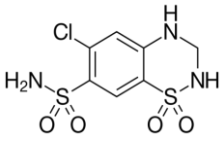
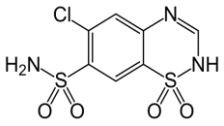
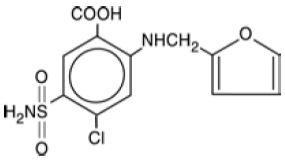
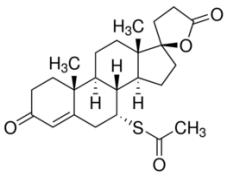
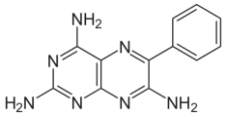
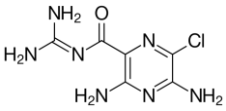
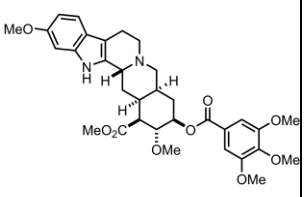
Nidhi Sharma
Faculty of HIMT College of Pharmacy, Greater Noida, Uttar Pradesh, India

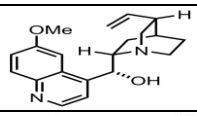
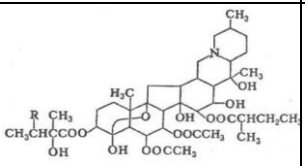
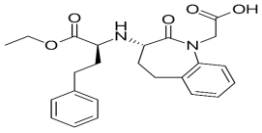
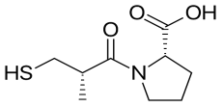
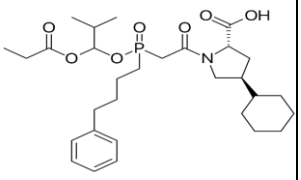
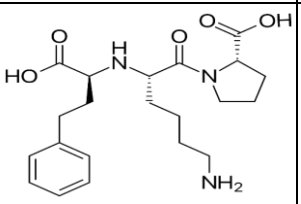
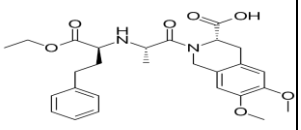
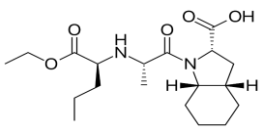
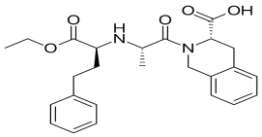
Abstract
Cardiovascular disease is most commonly found and is mainly caused by tobacoo use, physical inactivity, and due to unhealthy diet. It is observed by many survey that is occur equally in men & women both. It is that class of drug which involve the heart or blood vessels. Cardiovascular disease includes coronary artery diseases such as angina and myocardial infarction (also known as a heart attack). Other cardiovascular disease include stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis.

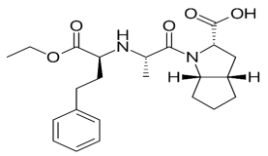
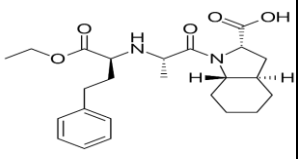
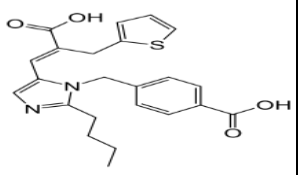
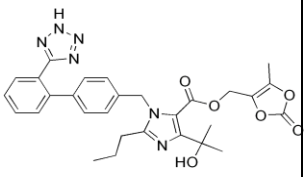
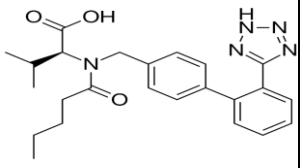
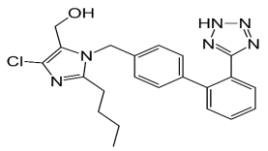
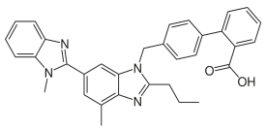
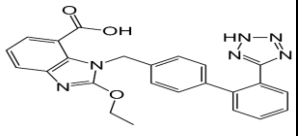
Keywords: cardiovascular, peripheral, thromboembolic, thrombosis

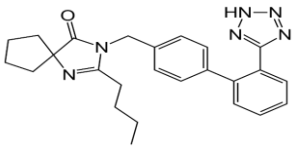
1. Introduction
This review article has a list of Nitrogen containing heterocyclic compound or drugs which are employed in the treatment of different Cardiovascular disease. It includes name of the drugs along with their mechanism of action & structures.

S. No	Name of Drug	Structure	Mechanism of action
1	Nifedipin		▪ It decreases arterial smooth muscle contractility and subsequent vasoconstriction by inhibiting the influx of calcium ions through L-type calcium channels. ▪ Calcium ions entering the cell through these channels bind to calmodulin. Calcium-bound calmodulin then binds to and activates myosin light chain kinase (MLCK). ▪ Activated MLCK catalyzes the phosphorylation of the regulatory light chain subunit of myosin, a key step in muscle contraction. ▪ Signal amplification is achieved by calcium-induced calcium release from the sarcoplasmic reticulum through ryanodine receptors. ▪ Inhibition of the initial influx of calcium inhibits the contractile processes of smooth muscle cells, causing dilation of the coronary and systemic arteries, increased oxygen delivery to the myocardial tissue, decreased total peripheral resistance, decreased systemic blood pressure, and decreased afterload. ▪ The vasodilatory effects of this drug result in an overall decrease in blood pressure.
2	Diltiazem (Calcium Channel Blocker)		▪ It is a benzothiazepine derivative with anti-hypertensive, antiarrhythmic properties. ▪ It blocks voltage-sensitive calcium channels in the blood vessels, by inhibiting the ion-control gating mechanisms, thereby preventing calcium levels increase by other revenues. ▪ It also interferes with the release of calcium from the sarcoplasmic reticulum and inhibits the influx of extracellular calcium across both the myocardial and vascular smooth muscle cell membranes. ▪ The overall low calcium levels leads to dilatation of the main coronary and systemic arteries and decreasing myocardial contractility, decreased peripheral arterial resistance, improved oxygen delivery to the myocardial tissue, and decreased cardiac output.
3	Verapamil (Calcium Channel blocker)		▪ It is a phenylalkylamine calcium channel blocking agent. ▪ It inhibits the transmembrane influx of extracellular calcium ions into myocardial and vascular smooth muscle cells, causing dilatation of the main coronary and systemic arteries and decreasing myocardial contractility. ▪ This drug also inhibits the drug efflux pump P-glycoprotein which is overexpressed in some multi-drug resistant tumor and may improve the efficacy of some antineoplastic agents.

4	▪ Thiazides Diuretics		
5	Hydrochlorthiazide		▪ It reduces the reabsorption of electrolytes from the renal tubules. ▪ This results in increased excretion of water and electrolytes, including sodium, potassium, chloride, and magnesium. ▪ It is used in the treatment of several disorders including edema, hypertension, diabetes insipidus, and hypoparathyroidism.
6	Chlorthiazide		▪ This drug has an action similar to hydrochlorthiazide
7	Furosemide (Loop diuretic)		▪ It is a loop diuretic, inhibits water reabsorption in the nephron by blocking the sodium-potassium-chloride cotransporter in the thick ascending limb of the loop of Henle. ▪ This can be achieved through competitive inhibition at the chloride binding site on the cotransporter, thus preventing the transport of sodium from the lumen of the loop of Henle into the basolateral interstitium. ▪ Consequently, the lumen becomes more hypertonic while the interstitium becomes less hypertonic, which in turn diminishes the osmotic gradient for water reabsorption throughout the nephron. ▪ Because the thick ascending limb is responsible for 25% of sodium reabsorption in the nephron, furosemide is a very potent diuretic.
8	Spironolactone		▪ It competitively binding to receptors present at the aldosterone-dependent sodium-potassium exchange site in the distal convoluted renal tubule. ▪ It causes increased amounts of sodium and water to be excreted, while potassium is retained. ▪ It acts both as a diuretic and as an antihypertensive drug by this mechanism. ▪ Aldosterone (Aldosterone is a hormone; its primary function is to retain sodium and excrete potassium in the kidneys) interacts with a cytoplasmic mineralocorticoid receptor to enhance the expression of the Na+, K+-ATPase and the Na+ channel involved in a Na+ K+ transport in the distal tubule. ▪ Spironolactone bind to the mineralcorticoid receptor, blocking the actions of aldosterone on gene expression.
9	Triamterene		▪ Triamterene is a pteridine derivative with potassium-sparing diuretic property. ▪ It blocks the sodium-potassium exchange pump (Na-K-ATPase) in the luminal membrane of principal cells in the late distal tubule, cortical collecting tubule and collecting duct in the kidney. ▪ This reversible inhibition of the electrogenic sodium transport decreases the lumen-negative transepithelial potential difference and thus reduces the driving force for K+ movement into the tubular lumen resulting in the inhibition of sodium reabsorption in exchange for K+ and H+.
10	Amiloride (Potassium sparing diuretics)		▪ It is a Potassium-sparing Diuretic. The physiologic effect of amiloride is by means of Decreased Renal K+ Excretion, and Increased Diuresis. ▪ Amiloride inhibits sodium channels located in the distal tubules and collecting ducts of the kidney, thereby preventing the absorption of sodium and increasing its excretion along with water, to produce naturesis. In response to the hypernatremic conditions in the kidney, the plasma membrane becomes hyperpolarized and electrochemical forces are reduced, which then prevents the excretion of potassium and hydrogen into the lumen.
11	Reserpine (Catecholamine-depleting Sympatholytic)		▪ This drug binds and inhibits catecholamine pump on the storage vesicles in central and peripheral adrenergic neurons, thereby inhibiting the uptake of norepinephrine, dopamine serotonin into presynaptic storage vesicles. ▪ Which results in catecholamines and serotonin lingering in the cytoplasm where they are destroyed by intraneuronal monoamine oxidase, thereby causing the depletion of catecholamine and serotonin stores in central and peripheral nerve terminals. ▪ Depletion results in a lack of active transmitter discharge from nerve endings upon nerve depolarization, and consequently leads to a decreased heart rate and decreased arterial blood pressure as well as sedative effects.

12	Quinine (Quinoline alkaloid)- (Antimalarial drug)		▪ This drugs interferes with the parasite's ability to break down and digest hemoglobin. Which results, the parasite starves and/or builds up toxic levels of partially degraded hemoglobin in itself.
13	Protoveratrin		▪ This drug elicits reflex bradycardia and vasodilation by stimulation of the receptor in the heart supplied by sensory vagus.
14	Benazepril (Angiotensin converting enzyme inhibitor)		▪ Benazepril is a carboxyl-containing angiotensin-converting enzyme (ACE) inhibitor with antihypertensive activity. As a prodrug, benazepril is metabolized to its active form benazeprilat. ▪ Benazeprilat competitively binds to and inhibits ACE, thereby blocking the conversion of angiotensin I to angiotensin II. ▪ This prevents the potent vasoconstrictive actions of angiotensin II resulting in vasodilation. ▪ Benazeprilat also decreases angiotensin II-induced aldosterone secretion by the adrenal cortex, which leads to an increase in sodium excretion and subsequently increases water outflow.
15	Captopril (Angiotensin Converting Enzyme Inhibitor.)		▪ Captopril is a sulfhydryl-containing analog of proline with antihypertensive activity and potential antineoplastic activity. ▪ It competitively inhibits angiotensin converting enzyme (ACE), thereby decreasing levels of angiotensin II, increasing plasma renin activity, and decreasing aldosterone secretion. ▪ This agent may also inhibit tumour angiogenesis by inhibiting endothelial cell matrix metalloproteinases (MMPs) and endothelial cell migration. ▪ It may also exhibit antineoplastic activity independent of effects on tumour angiogenesis.
16	Fosinopril (Phosphinic acid containing angiotensin converting enzyme inhibitor)		▪ It is a phosphinic acid-containing angiotensin-converting enzyme (ACE) inhibitor with antihypertensive activity. As an ester prodrug, fosinopril is hydrolysed by esterases to its active metabolite fosinoprilat. ▪ It specifically and competitively inhibits angiotensin-converting enzyme thereby decreasing the formation of the potent vasoconstrictor angiotensin II, resulting in diminished vasopressor activity. ▪ Along with this, angiotensin II mediated aldosterone secretion by adrenal cortex is decreased, which results in a decrease of sodium retention and an increase in water outflow.
17	Lisinopril (Angiotensin Converting Enzyme Inhibitor)		▪ It competitively binds to and inhibits ACE, thats why blocking the conversion of angiotensin I to angiotensin II. ▪ This prevents the potent vasoconstrictive actions of angiotensin II and results in vasodilation. ▪ It also decreases angiotensin II induced aldosterone secretion by the adrenal cortex, which leads to an increase in sodium excretion and subsequently increases water outflow.
18	Moexipril		▪ Moexipril is a prodrug, so it hydrolyzed into its active form moexiprilat, which competitively inhibits ACE, thereby blocking the conversion of angiotensin I to angiotensin II. ▪ This prevents the actions of the potent vasoconstrictor angiotensin II and leads to vasodilation. ▪ It also prevents angiotensin II-induced aldosterone secretion by the adrenal cortex, thereby promoting diuresis and natriuresis.
19	Peridopril (Angiotensin Converting Enzyme Inhibitor)		▪ Perindopril is a non-sulfhydryl angiotensin converting enzyme (ACE) inhibitor with antihypertensive activity. ▪ On hydrolysis, perindopril is converted to its active form perindoprilat, inhibiting ACE and the conversion of angiotensin I to angiotensin II. ▪ Finally, angiotensin II-mediated vasoconstriction and angiotensin II-stimulated aldosterone secretion from the adrenal cortex are inhibited and diuresis and natriuresis ensue.
20	Quinapril (Non-sulfhydryl angiotensin converting enzyme (ACE) inhibitor)		▪ Quinapril is hydrolized into its active form Quinaprilat, which binds to and inhibits ACE, thereby blocking the conversion of angiotensin I to angiotensin II. ▪ This stops the potent vasoconstrictive actions of angiotensin II and leads to vasodilatation. ▪ It also causes a decrease in angiotensin II-induced aldosterone secretion

			by the adrenal cortex, thereby promoting diuresis and natriuresis, and increases bradykinin levels.
21	Ramipril (Long-acting angiotensin-converting enzyme inhibitor)		▪ Ramipril is converted into its active form ramiprilat, which inhibits ACE, thereby blocking the conversion of angiotensin I to angiotensin II. ▪ This stops the potent vasoconstrictive actions of angiotensin II and leads to vasodilatation. ▪ This drug also causes an increase in bradykinin levels and a decrease in angiotensin II-induced aldosterone secretion by the adrenal cortex, thereby promoting diuresis and natriuresis.
22	Trandolapril (Non-sulfhydryl Angiotensin Converting Enzyme Inhibitor)		▪ Its active form is trandolaprilat. Then this active form will competitively bind to and inhibits ACE, thereby blocking the conversion of angiotensin I to angiotensin II. ▪ This prevents the potent vasoconstrictive actions of angiotensin -II & which results in Vasodilation. ▪ This drug also decrease Angiotensin- II induced aldosterone secreation by the adrenal cortex, which leads to an increase in sodium excretion and subsequently increases water outflow.
23	Eprosartan (Angiotensin- II receptor blocker)		▪ It is a competitive and reversible Angiotensin- II receptor antagonist with anti-hypertensive property. ▪ This drug blocks the binding of angiotensin II to the angiotensin I receptor in vascular smooth muscle, thereby blocking the principal pressor action of angiotensin II on the renin-angiotensin system resulting in vascular dilatation. ▪ In addition, this agent blocks angiotensin II -induced stimulation of aldosterone synthesis and secretion by the adrenal cortex, cardiac contraction, renal resorption of sodium, activity of the sympathetic nervous system, and smooth muscle cell growth. ▪ It also inhibits sympathetic norepinephrine production, thereby further reducing blood pressure.
24	Olmesartan (Angiotensin 2 Receptor Blocker)		▪ It selectively binds to the angiotensin type 1 receptor subtype in vascular smooth muscle and adrenal gland, thereby competing with angiotensin II for binding to the angiotensin I receptor. ▪ This prevents angiotensin II-induced vasoconstriction and interferes with angiotensin II- mediated aldosterone secretion. ▪ Thereby decreasing aldosterone production and preventing aldosterone-stimulated sodium retention and potassium excretion.
25	Valsartan (Tetrazole derivative and angiotensin-1 receptor blocker)		▪ It selectively and competitively blocks the binding of Angiotensin II to the Angiotensin I subtype receptor in vascular smooth muscle and the adrenal gland, preventing Angiotensin II-mediated vasoconstriction, aldosterone synthesis and secretion, and renal reabsorption of sodium. ▪ Which results in vasodilation, increased excretion of sodium and water, a reduction in plasma volume, and a reduction in blood pressure.
26	Losartan (Angiotensin I receptor antagonist)		▪ Its potassium form active antagonist. ▪ Angiotensin II, formed from angiotensin I by angiotensin-converting enzyme (ACE), stimulates the adrenal cortex to synthesize and secrete aldosterone, which decreases the excretion of sodium and increases the excretion of potassium. ▪ Angiotensin II also acts as a vasoconstrictor in vascular smooth muscle. ▪ Losartan potassium, by blocking the binding of angiotensin II to the Angiotensin 1 receptor, promotes vasodilatation and decreases the effects of aldosterone.
27	Telmisartan (Angiotensin 2 Receptor Blocker)		▪ It selectively antagonizes angiotensin II binding to the Angiotensin 1 subtype receptor, located in vascular smooth muscle and adrenal gland. ▪ The antagonism results in vasodilation and inhibits the angiotensin II-mediated aldosterone production. ▪ Which in turn leading to a decrease in sodium and water as well as an increase in potassium excretion leading to a subsequent reduction in blood pressure
28	Candesartan (Angiotensin-II Receptor Blocker)		▪ It selectively competes with angiotensin II for the binding of the angiotensin II receptor subtype 1 (AT1) in vascular smooth muscle, blocking angiotensin II-mediated vasoconstriction and inducing vasodilatation. ▪ In addition, antagonism of AT1 in the adrenal gland inhibits and angiotensin II stimulated aldosterone synthesis and secretion by the adrenal cortex, sodium and water excretion increase, followed by a reduction in plasma volume and blood pressure.

29	Irbesartan (Angiotensin-2 Receptor Blocker)		▪ Irbesartan selectively and competitively blocks the binding of angiotensin II to the angiotensin I receptor. ▪ Angiotensin II stimulates aldosterone synthesis and secretion by adrenal cortex, which decreases the excretion of sodium and increases the excretion of potassium. ▪ Angiotensin II also acts as a vasoconstrictor in vascular smooth muscle.

References

1. All mechanism of action is from Pubchem & Drug bank.
2. All structures from Google.