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Review Article

PHARMACOKINETIC DATA AND SOLUBILITY PROFILE OF ANTIHYPERTENSIVE DRUGS

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Abstract

Pharmacokinetic data and solubility profile of drugs are the basic requirement of any researcher, for selecting an appropriate drug for any kind formulation development. To get such data of all the drugs of one category at one place is very difficult task, we by our review article have tried to give all such data of antihypertensive drugs at one place.

Introduction

The **Antihypertensives** are a class of drugs that are used to treat hypertension (high blood pressure)

Diuretics

Diuretics help the kidneys eliminate excess salt and water from the body's tissues and blood.

- Loop diuretics:
  - bumetanide
  - ethacrynic acid
  - furosemide
  - torsemide
- Thiazide diuretics:
  - epitizide
  - hydrochlorothiazide and chlorothiazide
  - bendroflumethiazide
- Thiazide-like diuretics:
  - indapamide
  - chlorthalidone
  - metolazone
- Potassium-sparing diuretics:
  - amiloride
  - triamterene
  - spironolactone

Propranolol, the first beta-blocker to be successfully developed

- Beta blockers
  - atenolol
  - metoprolol
  - nadolol
  - oxprenolol
  - pindolol
  - propranolol
  - timolol
- Alpha blockers:
  - doxazosin
  - phentolamine
  - indoramin
  - phenoxybenzamine
  - prazosin
  - terazosin
  - tolazoline
- Mixed Alpha + Beta blockers:
  - bucindolol
  - carvedilol
  - labetalol

Adrenergic receptor agonists

- Alpha-2 agonists:
  - clonidine
  - methyldopa
  - Guanfacine

Calcium channel blockers

Calcium channel blockers block the entry of calcium into muscle cells in artery walls.

- dihydropyridines:
  - amlodipine
  - felodipine
  - isradipine
  - lercanidipine
  - nicardipine
  - nifedipine
  - nimodipine
  - nitrendipine
- non-dihydropyridines:
  - diltiazem
  - verapamil

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ACE inhibitors

ACE inhibitors inhibit the activity of Angiotensin-converting enzyme (ACE), an enzyme responsible for the conversion of angiotensin I into angiotensin II, a potent vasoconstrictor.

- captopril
- enalapril
- fosinopril
- lisinopril
- perindopril
- quinapril
- ramipril
- trandolapril
- benazepril

Angiotensin II receptor antagonists

Angiotensin II receptor antagonists work by antagonizing the activation of angiotensin receptors.

- candesartan
- eprosartan
- irbesartan
- losartan
- olmesartan
- telmisartan
- valsartan

Aldosterone antagonists

Aldosterone receptor antagonists:

- eplerenone
- spironolactone

Aldosterone antagonists are not recommended as first-line agents for blood pressure, but spironolactone and eplerenone are both used in the treatment of heart failure.

Vasodilators

Hydralazine

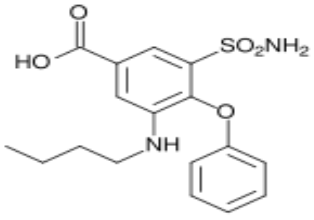
Centrally acting adrenergic drugs

- Clonidine
- Guanabenz
- Methyldopa
- Moxonidine

Some adrenergic neuron blockers are used for the most resistant forms of hypertension:

- Guanethidine
- Reserpine

Bumetanide[1]



Systematic (IUPAC) name [3-butylamino-4-phenoxy-5-sulfamoyl-benzoic acid]

Formula- **$C_{17}H_{20}N_2O_5S$**

Mol. mass- 364.417 g/mol

Solubility profile:-

Practically white powder. Slightly soluble in water. Soluble in alkaline solutions.(USP)**[2]**

Pharmacokinetic data:-

Bioavailability almost complete (~80%)

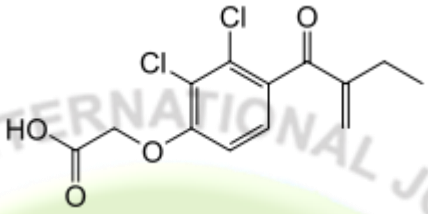
Protein binding 97%

Metabolism hepatic

Half life ~0.8 hours

Excretion renal

Etacrynic acid[3]



Systematic (IUPAC) name [2,3-dichloro-4-(2-methylenebutanoyl)phenoxy]acetic acid

Formula $C_{13}H_{12}Cl_2O_4$

Mol. mass 303.138 g/mol

Solubility profile:-

Freely soluble in ethanol(95%) in chloroform and in ether and very slightly soluble in water. It dissolve in ammonia and dilute aqueous solution of of alkali hydroxides and carbonates**[4]**

Pharmacokinetic parameters:-

Oral bioavailability 100%

Half life 1hr

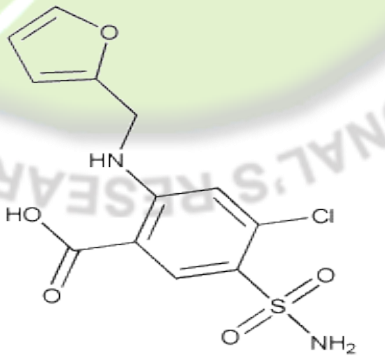
Route of elimination 67% renal

33% metabolism

Total daily dose 25-50

50-100 mg i.v

Furosemide[5]



Chemical Formula: $C_{12}H_{11}ClN_2O_5S$

Chemical data

Formula $C_{12}H_{11}ClN_2O_5S$

Mol. mass 330.745 g/mol

Solubility profile:- White to slightly yellow ,odourless,crystalline powder.practically insoluble in water.freely soluble in acetone and dimethyl formamide and solution of alkali hydroxides.Soluble in methanol,asparingly

soluble in alcohol , slightly soluble in ether and very slightly soluble in choloform.**[6]**

Pharmacokinetic data

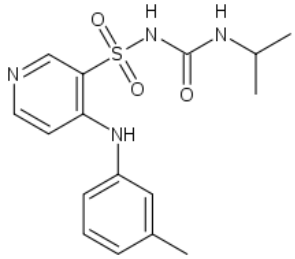
Bioavailability 43-69%

Metabolism hepatic and renal glucuronidation

Half life up to 100 minutes

Excretion renal 66%, biliary 33%

Torasemide[7]



Systematic (IUPAC) name *N*-[(isopropylamino)carbonyl]-4-[(3-methylphenyl)amino]pyridine-3-sulfonamide

Chemical data Formula $C_{16}H_{20}N_4O_3S$

Mol. mass 348.421 g/mol

Solubility Profile:-

White to slight yellow,odourless crystalline powder,practically insoluble in water.freely soluble in acetone and dimethyl formamide and in solutions of alkali hydroxides.soluble in methanol,asparingly soluble in alcohol,slightly soluble in ether ad very slightly soluble in choloform.B[**8]**

Pharmacokinetic data

Bioavailability 80-90%

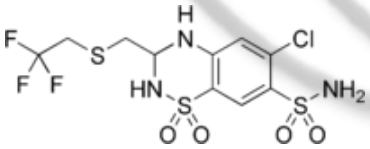
Protein binding Highly bound (>99%).

Metabolism Hepatic (80%)

Half-life 3.5 hours; Cirrhosis: 7-8 hours

Thiazide diuretics:

Epitizide[9]



IUPAC name[hide]

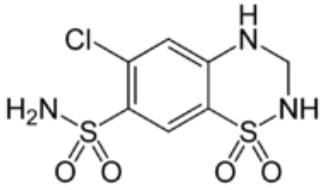
6-chloro-1,1-dioxo-3-(2,2,2-trifluoroethylsulfanylmethyl)-3,4-dihydro-2H-benzo[e][1,2,4]thiadiazine-7-sulfonamide

Properties

Molecular formula $C_{10}H_{11}ClF_3N_3O_4S_3$

Molar mass 425.85525

Hydrochlorothiazide[10]



Systematic (IUPAC) name 6-chloro-1,1-dioxo-3,4-dihydro-2*H*-1,2,4- benzothiadiazine-7-sulfonamide

Chemical data

Formula $C_7H_8ClN_3O_4S_2$

Mol. mass 297.74

Solubility profile:-

White or practically white,practically,odourless,crystalline powder,slightly soluble in water,freely soluble in sodium hydroxidesolution in n-butylamine amd in dimethyl formamide.sparingly soluble in methanol,insoluble in ether in choloform and in dilute mineral acid.**[11]**

Pharmacokinetic data

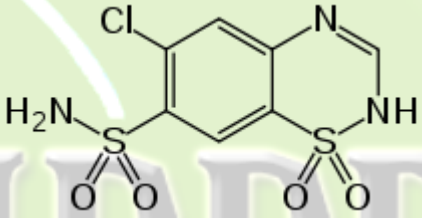
Bioavailability Variably absorbed from GI tract

Metabolism does not undergo significant metabolism (>95% excreted unchanged in urine)

Half-life 5.6-14.8 h

Excretion Primarily excreted unchanged in urine

Chlorothiazide[12]



Systematic (IUPAC) name 6-chloro-1,1-dioxo-2*H*-1,2,4-benzothiadiazine-7-sulfonamide

Solubility profile:-

White or practically white,crystalline odourless powder.melts ab about 340degree.very slightly soluble in water. free soluble in dimethyl formamide and dimethyl sulfoxide.sligtly soluble in methanol.practically soluble in ether ,in benzene ,in choloform**[13]**

Chemical data

Formula $C_7H_6ClN_3O_4S_2$

Mol. mass 295.72 g/mol.

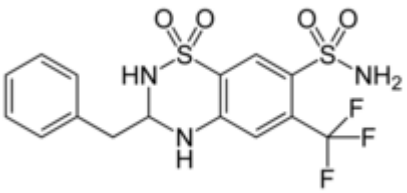
Pharmacokinetic data

Metabolism Nil

Half-life 45 to 120 minutes

Excretion Renal

Bendroflumethiazide[14]



Systematic (IUPAC) name 3-benzyl-1,1-dioxo-6-(trifluoromethyl)-3,4-dihydro-2*H*-1,2,4- benzothiadiazine-7-sulfonamide

Chemical data

Formula $C_{15}H_{14}F_3N_3O_4S_2$

Mol. mass 421.415 g/mol

Solubility profile:- white to cream coloured.finely divided crystalline powder.it is odouless or has a slight order.it melt at about 220 degree.practically insoluble in water.freely soluble in alcohol and acetone**[15]**

Pharmaconietic profile:-

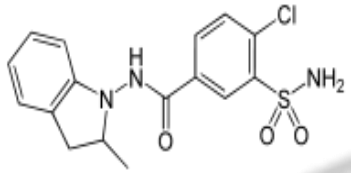
Bioavailability 100%

Protein binding 96%

Metabolism extensive

Half-life 3-4 hours

Indapamide[16]



Systematic (IUPAC) name 4-chloro-N-(2-methyl-2,3-dihydroindol-1-yl)- 3-sulfamoyl-benzamide

Solubility profile:-

White to off white,crystalline powder,melt between 167 and 170 degree.soluble in methanol,in alcohol,in acetonitrile,in glacial acetic acid and in ethyl acetate.very slightly soluble in ether and in choloform.Practically insoluble in water.[**17**]

Chemical data

Formula $C_{16}H_{16}ClN_3O_3S$

Mol. mass 365.835 g/mol

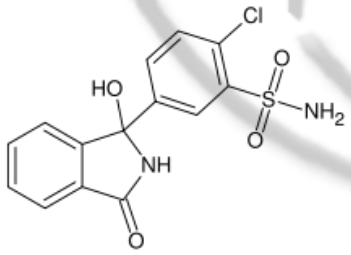
Pharmacokinetic data

Protein binding 71-79%

Metabolism Hepatic

Half-life 14-18 hours

Chlortalidone[18]



Systematic (IUPAC) name (*RS*)-2-chloro-5-(1-hydroxy-3-oxo-2,3-dihydro-1*H*-isoindol-1-yl)benzene-1-sulfonamide

Chemical data

Formula $C_{14}H_{11}ClN_2O_4S$

Mol. mass 338.766 g/mol

Solubility profile:- white to yellowish white crystalline powder.melts at a temperature above 215 degree.with decomposition practially inslouble in water,in ether and in choloform,soluble in methanol,slightly soluble in alcohol.**[19]**

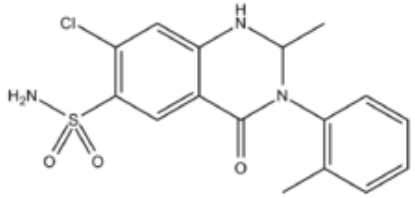
Pharmacokinetic data

Protein binding 75%

Half-life 40 hours

Excretion Renal

Metolazone[20]



Systematic (IUPAC) name 7-chloro-2-methyl-3-(2-methylphenyl)- 4-oxo-1,2-dihydroquinazoline-6-sulfonamide

Chemical data

Formula $C_{16}H_{16}ClN_3O_3S$

Mol. mass 365.835 g/mol

Pharmacokinetic data

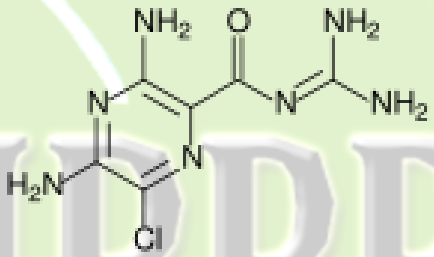
Bioavailability ~65%

Metabolism minimal

Half-life 14 hours

Excretion primarily urine

Amiloride[21]



Systematic (IUPAC) name 3,5-diamino-6-chloro-*N*-(diaminomethylene)pyrazine-2-carboxamide

Chemical data

Formula $C_6H_8ClN_7O$

Mol. mass 229.627 g/mol

Solubility profile:-yellow to greenish yellow, odourless or practically odourless powder.freely soluble in dimethyl sulphoxide, slightly soluble im methanol. insoluble in ether,in ethyl acetate,in acetone and in choloform.**[22]**

Pharmacokinetic data

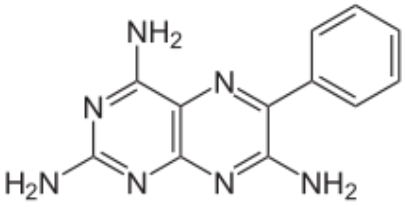
Bioavailability Readily absorbed

Metabolism none

Half-life 6 to 9 hours

Excretion unchanged in urine

Triamterene[23]



Systematic (IUPAC) name 6-phenylpteridine-2,4,7-triamine

Chemical data

Formula $C_{12}H_{11}N_7$

Mol. mass 253.263 g/mol

Solubility profile:-yellow, odourless, crystalline powder. practically insoluble in water,in benzene ,in choloform, in ether and in dilute alkali hydroxides. soluble in formic acid. springly soluble in methoxy ethanol. very slightly soluble in acetic acid,in alcohol and in dilute mineral acid.**[24]**

Pharmacokinetic data

Bioavailability 30-70% depending on formulation

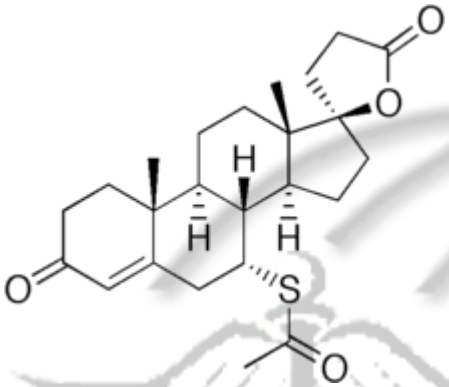
Protein binding 97%

Metabolism Liver/renal

Half-life 1-2 hours, active metabolite 3 hours

Excretion urine/bile/feces

Spironolactone[25]



Systematic (IUPAC) name 7α-Acetylthio-3-oxo-17α-pregn-4-ene-21,17-carbolactone

OR

(1' *S*,2*R*,2' *R*,9' *R*,10' *R*,11' *S*,15' *S*)-9'-(acetylsulfanyl)-2',15'-dimethylspiro[oxolane-2,14'-tetracyclo[8.7.0.0^{2,7}.0^{11,15}]heptadecan]-6'-ene-5,5'-dione

Chemical data

Formula $C_{24}H_{32}O_4S$

Mol. mass 416.574 g/mol

Pharmacokinetic data

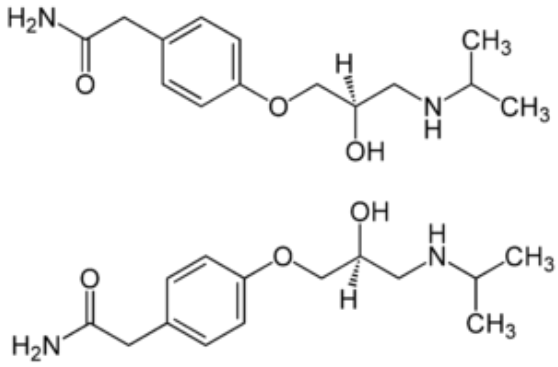
Metabolism Hepatic

Half-life 10 minutes

Excretion Urine, bile

Solubility profile:-light cream coloured to light tan,crysatalline powder.has a faint to mil mercaptan like odour,is stable in air.practically soluble in water.freely soluble in benzene and in chloroform.soluble in ethyl acetate and in alcohol,slightly soluble in methanol and fixed oils.**[26]**

Atenolol[27]



Systematic (IUPAC) name (*RS*)-2-{4-[2-hydroxy-3-(propan-2-ylamino)propoxy]phenyl}acetamide

Chemical data

Formula $C_{14}H_{22}N_2O_3$

Mol. mass 266.336 g/mol

Solubility profile:-white or practically white.odourless powder,melting piont 164 to 168 degree.freely soluble in methanol,sparingly soluble in alcohol,slightly soluble in water and in iso propanalol**[28]**

Pharmacokinetic data

Bioavailability 40-50%

Protein binding 6-16%

Metabolism Hepatic <10%

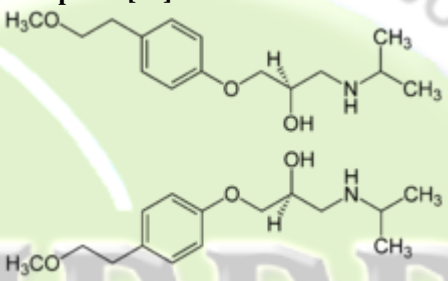
Half-life 6-7hours

Excretion

Renal

Lactic (In lactiferous females)

Metoprolol[29]



Systematic (IUPAC) name (*RS*)-1-(isopropylamino)-3-[4-(2-methoxyethyl)phenoxy]propan-2-ol

chemical data

Formula $C_{15}H_{25}NO_3$

Mol. mass 267.364 g/mol

Solubility profile:-very soluble in water,freely soluble in ethanol,in cholorofm and in dicholoromethane,slightly soluble in acetone,practically soluble in ether**[30]**

Pharmacokinetic data

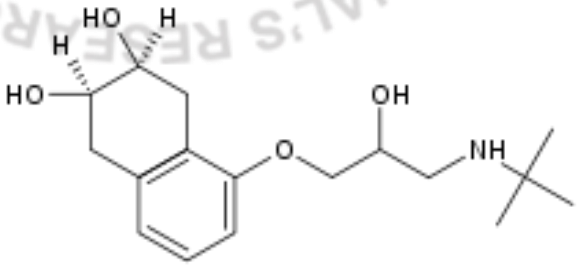
Bioavailability 12%

Metabolism Hepatic

Half-life 3-7 hours

Excretion Renal

Nadolol[31]



Systematic (IUPAC) name (2*R*,3*S*)-5-{[(2*R*)-3-(*tert*-butylamino)-2-hydroxypropyl]oxy}-1,2,3,4-tetrahydronaphthalene-2,3-diol

Chemical data

Formula **$C_{17}H_{27}NO_4$**

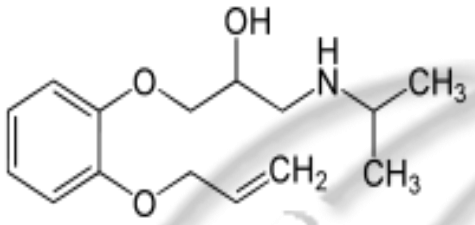
Mol. mass 309.401 g/mol

Solubility profile:-white to off white .practically odourless.crystalline powder,free soluble in alcohol and in mthanol.soluble in water at ph2,slihtly soluble in choloform in methylene chloride,in isopropyl alcohol and in water,insoluble in acetone,in benzene,in ether,in hexane andin tricholoroethane**[32]**

Pharmacokinetic data

Protein binding 30%
Metabolism Nil
Half-life 14-24 hours
Excretion Renal and fecal (unchanged)

Oxprenolol[33]



Systematic (IUPAC) name (*RS*)-1-[2-(allyloxy)phenoxy]-3-(isopropylamino)propan-2-ol

Chemical data

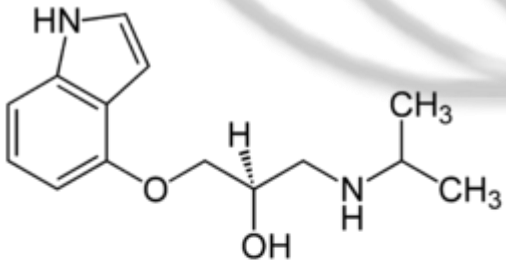
Formula $C_{15}H_{23}NO_3$
Mol. mass 265.348

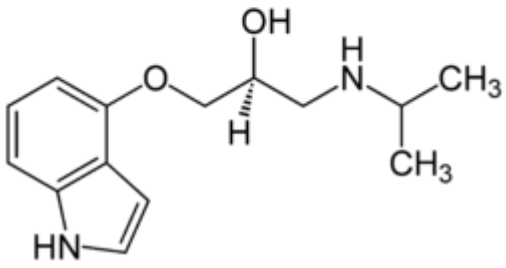
Soloubility profile:-white crystalline powder,freely soluble in alcohol,in choloform and in water.sparingly soluble in acetone,practically soluble in ether.**[34]**

Pharmacokinetic data

Bioavailability 20-70%
Metabolism Hepatic
Half-life 1-2hours
Excretion RenalLactic (In lactiferous females)

Pindolol[35]





Systematic (IUPAC) name (*RS*)-1-(1*H*-indol-4-yloxy)-3-(isopropylamino)propan-2-ol

Chemical data

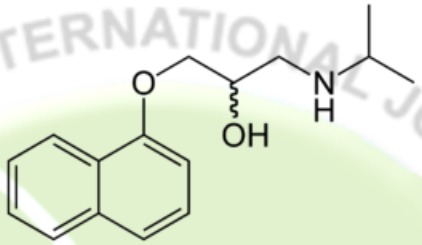
Formula $C_{14}H_{20}N_2O_2$
Mol. mass 248.321 g/mol

Solubility profile:-white to off white, crystalline powder ,having a faint odour, practically insoluble in water, slightly soluble in methanol ,very slightly soluble in choloform**[36]**

Pharmacokinetic data

Bioavailability 50% to 95%
Metabolism Hepatic
Half-life 3–4 hours
Excretion Renal

Propranolol[37]



Systematic (IUPAC) name (*RS*)-1-(isopropylamino)-3-(1-naphthyloxy)propan-2-ol

Chemical data

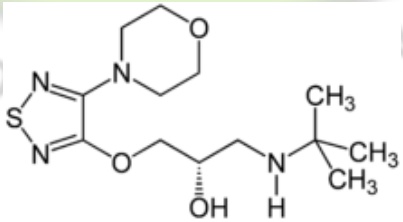
Formula $C_{16}H_{21}NO_2$
Mol. mass 259.34 g/mol

Solubility profile:-white to off white crystalline powder,odourless and has a bitter taste.melt at about 164 degree.soluble in water and in alcohol,slightly soluble in chloroform,practically insoluble in ether**[38]**

Pharmacokinetic data

Bioavailability 26%
Metabolism hepatic (extensive)
Half-life 4-5 hours
Excretion renal <1%

Timolol[39]



Systematic (IUPAC) name (*S*)-1-(*tert*-butylamino)-3-[(4-morpholin-4-yl-1,2,5-thiadiazol-3-yl)oxy]propan-2-ol

Chemical data

Formula $C_{13}H_{24}N_4O_3S$
Mol. mass 316.421 g/mol

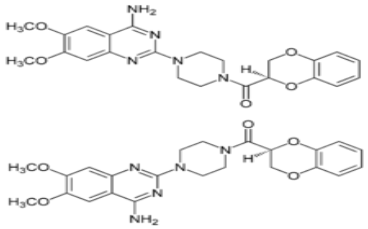
Solubility profile:- white to practically white,odourless and practically odourless powder.soluble in water,in alcohol and in methanol,sparingly soluble in chloroform and in propylene glychol,insoluble in ether and in cyclohexane.**[40]**

Pharmacokinetic data

Bioavailability 60%

Metabolism Hepatic: 80%
Half-life 2.5-5 hours
Excretion Renal

Doxazosin[41]



Systematic (IUPAC) name (*RS*)-2-{4-[(2,3-dihydro-1,4-benzodioxin-2-yl)carbonyl]piperazin-1-yl}-6,7-dimethoxyquinazolin-4-amine

Chemical data

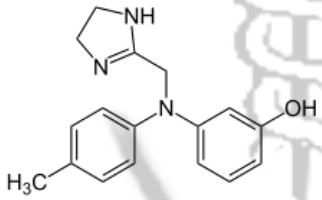
Formula $\mathbf{C_{23}H_{25}N_5O_5}$
Mol. mass 451.475 g/mol

Solubility profile:-white to tan colourd powder.freely soluble in formic acid,very slightly soluble in methanol and in water.**[42]**

Pharmacokinetic data

Bioavailability 65%
Protein binding 98%
Metabolism Hepatic
Half-life 22 hours

Phentolamine[43]



Systematic (IUPAC) name 3-[4,5-dihydro-1*H*-imidazol-2-ylmethyl- (4-methylphenyl)-amino]phenol

Chemical data

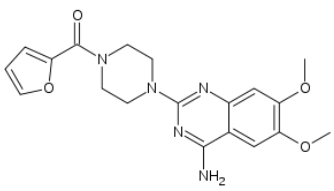
Formula $\mathbf{C_{17}H_{19}N_3O}$
Mol. mass 281.352 g/mol

Solubility profile:-white to off white,odourless crystalline powder,its solution are acid to litmus having a ph of about 5 and slowly deterorate,melt at about 178 degree,freely soluble in water,alcohol and slightly soluble in choloform.[44]

Pharmacokinetic data

Metabolism Hepatic
Half-life 19 minutes

Prazosin[45]



Systematic (IUPAC) name 2-[4-(2-furoyl)piperazin-1-yl]-6,7-dimethoxyquinazolin-4-amine

Chemical data

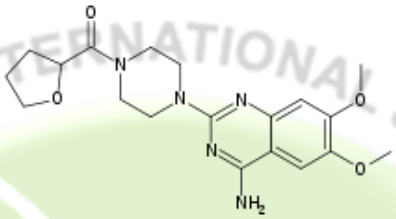
Formula $\mathbf{C_{19}H_{21}N_5O_4}$
Mol. mass 383.401 g/mol

Solubilty profile:-slightly soluble in methanol,very sligtly soluble in water,practically insoluble in chloroform and in acetone.**[46]**

Pharmacokinetic data

Bioavailability ~60%
Protein binding 97%
Half-life 2–3 hours

TERAZOSIN[47]



Systematic (IUPAC) name 6,7-dimethoxy-2-[4-(tetrahydrofuran-2-ylcarbonyl)piperazin-1-yl]quinazolin-4-amine

Chemical data

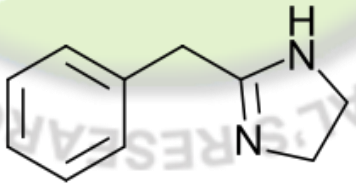
Formula $\mathbf{C_{19}H_{25}N_5O_4}$
Mol. mass 387.433 g/mol

Solubility Profile: - white to pale yellow , crytaline powder. Freely soluble in isotonic saline solution , soluble in methanol and in water , slightly soluble in alcohol and in 0.1N hydrochloride acid , very slightly soluble in chloroform , practically insoluate in aceton and in nexones.B**[48]**

Pharmacokinetic data

Protein binding 90-94%
Half-life 12 hours

Tolazoline[49]



Systematic (IUPAC) name 2-benzyl-4,5-dihydro-1*H*-imidazole

Chemical data

Formula $\mathbf{C_{10}H_{12}N_2}$
Mol. mass 160.216 g/mol

Solubility Profile:-white to off white , crystalline powder , its solution are slightly acid to litmus . freely soluble in water and in alcohol.**[50]**

Half-life:

Neonates—3 to 10 hours; however, reportedly as long as 40 hours, varying inversely with urine flow.

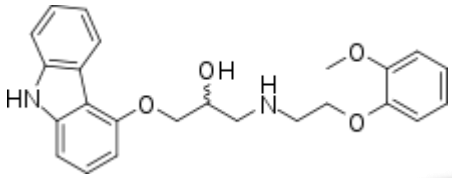
Onsetofaction:

Within 30 minutes after initial dose.

Elimination:

Renal, primarily unchanged.

Carvedilol[51]



Systematic (IUPAC) name (±)-[3-(9*H*-carbazol-4-yloxy)-2-hydroxypropyl][2-(2-methoxyphenoxy)ethyl]amine

Chemical data

Formula $\mathbf{C_{24}H_{26}N_2O_4}$

Mol. mass 406.474

Solubility Profile:-white as nearly white , crstaline powder , slightly soluble in alcohol , practically insoluble in water and in dilute acids.B**[52]**

Pharmacokinetic data

Bioavailability 25–35%

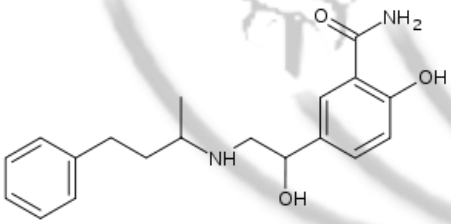
Protein binding 98%

Metabolism Liver (CYP2D6, CYP2C9)

Half-life 7–10 hours

Excretion Urine (16%), Feces (60%)

Labetalol[53]



Systematic (IUPAC) name (*RS*)-2-hydroxy-5-{1-hydroxy-2-[(1-methyl-3-phenylpropyl)amino]ethyl}benzamide

Chemical data

Formula $\mathbf{C_{19}H_{24}N_2O_3}$

Mol. mass 328.406 g/mol

Solubilty Profile:-white to off white powder . melts at about 180 with decomposition soluble in water and in aicohol , insoluble in ether and in chloroform.**[54]**

LABETALOL HYDROCHLORIDE:-springly soluble in water and in ethanol (95 percent) practically insoluble in choloroform and in ether (IP)

Pharmacokinetic data

Bioavailability 90-100%

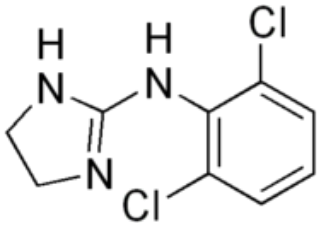
Protein binding 50%

Metabolism hepatic pass metabolism,

Half-life Tablet: 6-8 hours; IV: 5.5 hours

Excretion Excreted in urine, not removed by hemodialysis

Clonidine[55]



Systematic (IUPAC) name *N*-(2,6-dichlorophenyl)-4,5-dihydro-1*H*-imidazol-2-amine

Chemical data

Formula $\mathbf{C_9H_9Cl_2N_3}$

Mol. mass 230.093 g/mol

Solubility Profile:-freely soluble in water and in ethanol (95 percent) slightly soluble in chloroform , practically insoluble in ether.**[56]**

white to almost white , crystalline powder , melting point is about 130 , freely soluble in methanol and in alcohol.**(USP)**

Pharmacokinetic data

Bioavailability 75-95%

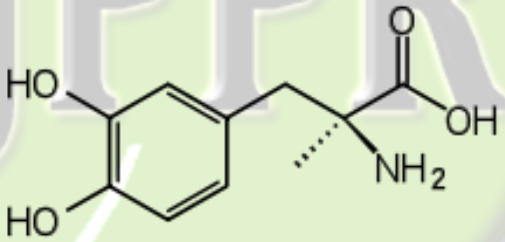
Protein binding 20-40%

Metabolism Hepatic to inactive metabolites

Half-life 12-33 hours

Excretion urine (40-50%)

Methyldopa[57]



Systematic (IUPAC) name (*S*)-2-amino-3-(3,4-dihydroxyphenyl)-2-methyl-propanoic acid

Chemical data

Formula $\mathbf{C_{10}H_{13}NO_4}$

Mol. mass 211.215 g/mol

Solubility Profile:-slightly soluble in water , very slightly soluble in ethanol (95 percent) , practically insoluble in chloroform ans in ether , soluble , soluble in dilute hydrochloride acid.(**IP)**

white to yellowish white , odorless , fine powder which may contain friable lumps , spiringly soluble in water , very soluble in 3N hydrochloride acid , slightly soluble in alcohol , practically insoluble in ether.**(USP)[58]**

Pharmacokinetic data

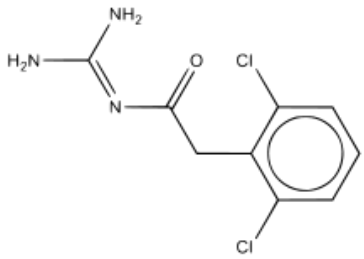
Bioavailability approximately 50%

Metabolism Hepatic

Half-life 105 minutes

Excretion Renal for metabolites

Guanfacine[59]



Systematic (IUPAC) name *N*-(diaminomethylidene)-2-(2,6-dichlorophenyl)acetamide

Chemical data

Formula $\mathbf{C_9H_9Cl_2N_3O}$

Mol. mass 246.093 g/mol

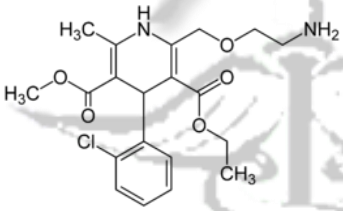
Pharmacokinetic data

Bioavailability 99.9%

Half-life 14.8–18.3 h

Excretion renal

Amlodipine[60]



Systematic (IUPAC) name (*RS*)-3-ethyl 5-methyl 2-[(2-aminoethoxy)methyl]-4-(2-chlorophenyl)-6-methyl-1,4-dihydropyridine-3,5-dicarboxylate

Chemical data

Formula $\mathbf{C_{20}H_{25}ClN_2O_5}$

Mol. mass 408.879 g/mol

Solubility Profile:-slightly soluble in water , freely soluble in methanol , spiringly soluble in ethanol (95 percent) , slightly soluble in 2-propanol.**{IP}**

A white or almost white powder , freely soluble in methanol , sparingly soluble in alcohol , slightly soluble in 2-propanolol and in water.{**USP[61]**

Pharmacokinetic data

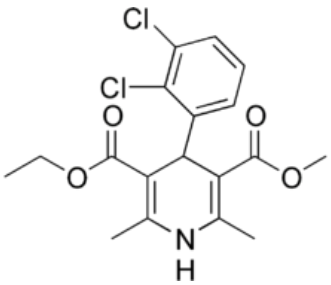
Bioavailability 64 to 90%

Metabolism HepaticNikhil and Nilesh filed a patent on amlodipine

Half-life 30 to 50 hours

Excretion Renal

Felodipine[62]



Systematic (IUPAC) name 3-ethyl 5-methyl 4-(2,3-dichlorophenyl)-2,6-dimethyl-1,4-dihydropyridine-3,5-dicarboxylate

Chemical data

Formula $\mathbf{C_{18}H_{19}Cl_2NO_4}$

Mol. mass 384.259 g/mol

Solubility Profile:-light yellow to yellow , crystalline powder , freely soluble in acetone and in methanol , very slightly soluble in neptane , insoluble in water.**[63]**

Pharmacokinetic data

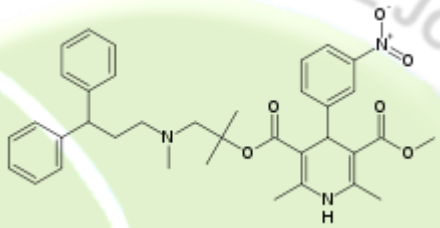
Bioavailability 15%

Metabolism Hepatic

Half-life ??

Excretion Renal

Lercanidipine[64]



Systematic (IUPAC) name 2[(3,3-diphenylpropyl)(methyl)amino]-1,1-dimethylethyl methyl 2,6-dimethyl-4-(3-nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate

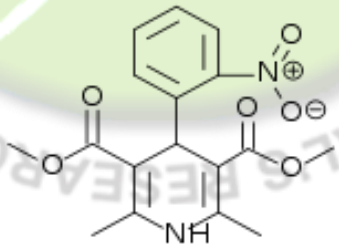
Chemical data

Formula $\mathbf{C_{36}H_{41}N_3O_6}$

Mol. mass 611.727 g/mol

Solubility Profile:- microcrystaline , odorless , citrive powder , reading soluble in chloroform and methanol practically insoluble in water.

Nifedipine[65]



Systematic (IUPAC) name 3,5-dimethyl 2,6-dimethyl-4-(2-nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate

Chemical data

Formula $\mathbf{C_{17}H_{18}N_2O_6}$

Mol. mass 346.335 g/mol

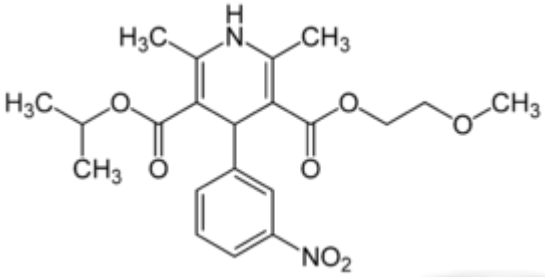
Solubility Prifile:- yellow powder , is affected by exposene to light practically insoluble in water , freely soluble in acetone.

Freely soluble in acetone and in chloroform spiringly soluble in ethanol , practically insoluble in water.**[66]**

Physical data Melt. point 173 °C (343 °F)

Pharmacokinetic data
Bioavailability 45-56%
Protein binding 92-98%
Metabolism Gastrointestinal, Hepatic
Half-life 2 hours
Excretion Renal: >50%, Biliary: 5-15%

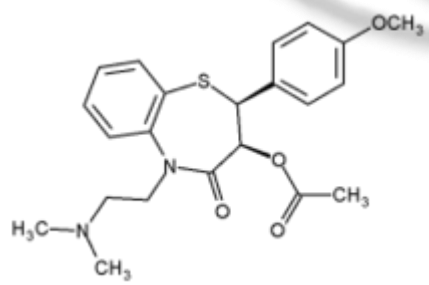
Nimodipine[67]



Systematic (IUPAC) name 3-(2-methoxyethyl) 5-propan-2-yl 2,6-dimethyl-4-(3-nitrophenyl)-1,4-dihydropyridine-3,5-dicarboxylate
Chemical data
Formula $\mathbf{C_{21}H_{26}N_2O_7}$
Mol. mass 418.44 g/mol
Physical data Melt. point 7 ℃ (45 °F)
Solubility Profile :-light yellow or yellow , crystalline powder , affected by light , freely soluble in ethyl acetate spiringly soluble in alcohol , practically insoluble in water , exhibits polymorphism. **[68]**

Pharmacokinetic data
Bioavailability 100% (Intravenous) 13% (Oral)
Protein binding 95%
Metabolism Hepatic
Half-life 8–9 hours
Excretion Feces and Urine

Diltiazem[69]

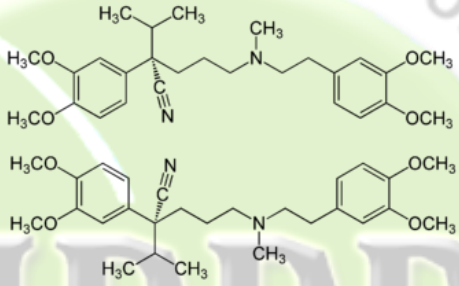


Systematic (IUPAC) name *cis*-(+)-[2-(2-dimethylaminoethyl)-5-(4-methoxyphenyl) -3-oxo-6-thia-2-azabicyclo[5.4.0]undeca-7,9, 11-trien-4-yl]ethanoate
Chemical data
Formula $\mathbf{C_{22}H_{26}N_2O_4S}$
Mol. mass 414.519 g/mol

Solubility Profile:-white, odorless, crystalline powder or small crystals. freely soluble in chloroform , in punic acid , in methanol and in water , sparingly soluble in dehytreted alcohol , insoluble in ether , helds at about 210 with decomposition.(**USP}[70]**
Freely soluble in chloroform , in methanol , in water and in punic acid , sparingly soluble in ethanol , insoluble in ether.{**IP)**

Pharmacokinetic data
Bioavailability 40%
Metabolism Hepatic
Half-life 3-4.5 hours
ExcretionRenal
Biliary
Lactic (in lactiferous females)

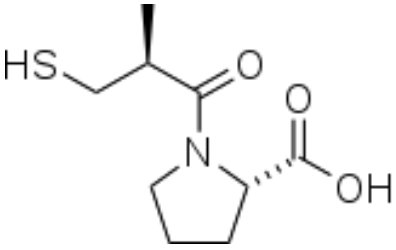
Verapamil[71]



Systematic (IUPAC) name (*RS*)-2-(3,4-dimethoxyphenyl)-5-{[2-(3,4-dimethoxyphenyl)ethyl]-(methyl)amino}-2-prop-2-ylpentanenitrile
Chemical data
Formula $\mathbf{C_{27}H_{38}N_2O_4}$
Mol. mass 454.602 g/mol
Solubility Profile:-white or practically , white crystalline powder , is practically odorless and has bitter taste , soluble in water , freely soluble in ethanol (95percent) practically insolublein ether.
Freely soluble in chloroform , soluble in water , sparingly in ethanol (95 percent) practically insoluble in ether.**[72]**

Pharmacokinetic data
Bioavailability 35.1%
Metabolism Hepatic
Half-life 2.8-7.4 hours
Excretion Renal: 11%

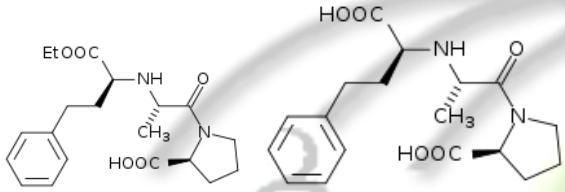
Captopril[73]



Systematic (IUPAC) name (*2S*)-1-[(*2S*)-2-methyl-3-sulfanylpropanoyl] pyrrolidine-2-carboxylic acid

Chemical data
Formula $C_9H_{15}NO_3S$
Mol. mass 217.29
Solubility Profile:-white to off white , crystalline powder , which may have a characterstics , sulfide like-odour , melts in positiverange of 104 to 110 freely soluble in water , in methanol and in chloroform.**[74]**
Freely soluble in water , in methanol , in ethanol (95 percent) and in chloroform.
Pharmacokinetic data
Bioavailability 70–75%
Metabolism hepatic
Half-life 1.9 hours
Excretion renal

Enalapril[75]

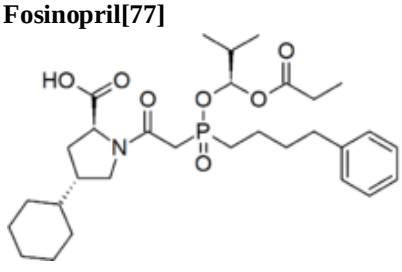


Systematic (IUPAC) name (2*S*)-1-[(2*S*)-2-{[(2*S*)-1-ethoxy-1-oxo-4-phenylbutan-2-yl]amino}propanoyl]pyrrolidine-2-carboxylic acid

(Diagrams above are enalapril and enalaprilat, respectively. Data below refers to enalapril unless indicated)

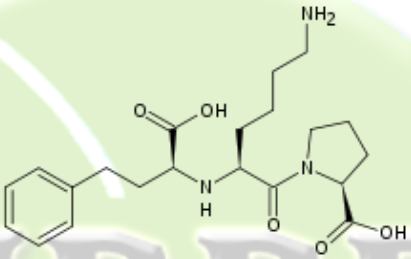
Chemical data
Formula $C_{20}H_{28}N_2O_5$
Mol. mass 376.447 g/mol
Solubility Profile:-off white , crystalline powder , hedls about 144 practically in soluble in non-polar organic solvents slightly soluble in semipolar organic solvents sparingly soluble in water , soluble in alcohol , freely soluble in methanol and dimethylpimamides
Freely soluble in methanol and in dimethylpimamide , soluble in ethanol (95 percent) sparingly soluble in water , slightly soluble in semipolar organic solvents , practically insoluble in non-polar organic solvents.**[76]**
Pharmacokinetic data
Bioavailability 60% (oral)
Metabolism hepatic (to enalaprilat)
Half-life 11 hours (enalaprilat)
Excretion renal

Fosinopril[77]



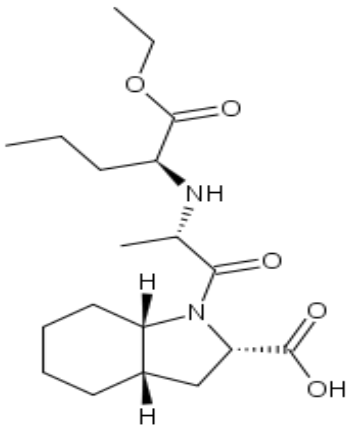
Systematic (IUPAC) name (2*S*,4*S*)-4-cyclohexyl-1-(2-{[2-methyl-1-(propanoyloxy)propoxy](4-phenylbutyl)phosphoryl}acetyl)pyrrolidine-2-carboxylic acid
Chemical data
Formula $C_{30}H_{46}NO_7P$
Mol. mass 563.663 g/mol
Experimental Water Solubility Insoluble
Predicted Water Solubility 1.01e-03 mg/mL
Experimental LogP/Hydrophobicity 6.3
Pharmacokinetic data
Bioavailability ~36%
Protein binding 87% (fosinoprilat)
Metabolism hepatic, GIT mucosa (to fosinoprilat)
Half-life 12 hours (fosinoprilat)
Excretion renal

Lisinopril[78]



Systematic (IUPAC) name N^2-[(1*S*)-1-carboxy-3-phenylpropyl]-L-lysyl-L-proline
Chemical data
Formula $C_{21}H_{31}N_3O_5$
Mol. mass 405.488 g/mol
Solubility Profile:-white , crystalline melts at about 160 with decomposition , soluble in water , sparingly soluble in methanol , practically insoluble in alcohols , in acetone , in acetonitrile and in chloroform.**[79]**
Pharmacokinetic data
Bioavailability approx. 25%, but wide range between individuals (6 to 60%)
Protein binding 0
Metabolism None
Half-life 12 hours
Excretion Eliminated unchanged in Urine

Perindopril[80]



Systematic (IUPAC) name 'H-*indole-2-carboxylic acid*

Chemical data

Formula $C_{19}H_{32}N_2O_5$

Mol. mass 368.468 g/mol

Solubility Profile:-it is a white powder , reading soluble in purified water , ethanol and chloroform.**[IP]**

Pharmacokinetic data

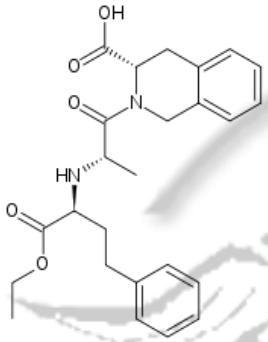
Bioavailability 24%

Protein binding 20%

Metabolism Renal

Half-life 1 hour - 17 hours for perindoprilat (active metabolite)

Quinapril[81]



Systematic (IUPAC) name (3*S*)-2-[(2*S*)-2-{[(2*S*)-1-ethoxy-1-oxo-4-phenylbutan-2-yl]amino}propanoyl]-1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid

Chemical data

Formula $C_{25}H_{30}N_2O_5$

Mol. mass 438.516 g/mol

Solubility Profile:-white to off white powder , with opink cost at times , freely soluble in aqueour solvents.

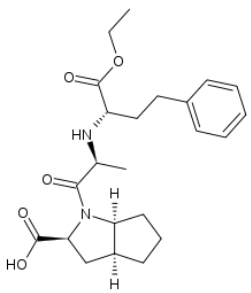
Tmax is 1 hr per duf , quinapril tmax is 2N per metelolite , quinapril at . food decrease rate 25% and extent of aluaption 30% when administred with a high fat meal.**[82]**

Pharmacokinetic data

Protein binding 97%

Half-life 2 hours

Ramipril[83]



Systematic (IUPAC) name (2*S*,3*aS*,6*aS*)-1-[(2*S*)-2-{[(2*S*)-1-ethoxy-1-oxo-4-phenylbutan-2-yl]amino}propanoyl]-octahydrocyclopenta[*b*]pyrrole-2-carboxylic acid

Chemical data

Formula $C_{23}H_{32}N_2O_5$

Mol. mass 416.511 g/mol

Solubility Profile:-spiringly in water , freely soluble in methanol. White to almost white crystalline powder . freely soluble in methanol , sparingly soluble in water.**[84]**

Pharmacokinetic data

Bioavailability 28%

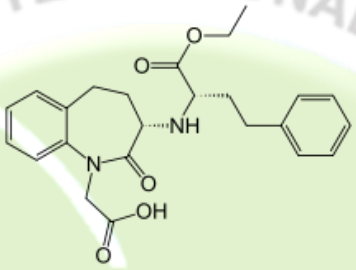
Protein binding 73% (ramipril) 56% (ramiprilat)

Metabolism Hepatic, to ramiprilat

Half-life 2 to 4 hours

Excretion Renal (60%) and fecal (40%)

Benazepril[85]



Systematic (IUPAC) name 2-[(3*S*)-3-{[(2*S*)-1-ethoxy-1-oxo-4-phenylbutan-2-yl]amino}-2-oxo-2,3,4,5-tetrahydro-1*H*-1-benzazepin-1-yl]acetic acid

Chemical data

Formula $C_{24}H_{28}N_2O_5$

Mol. mass 424.49 g/mol

Solubility Profile:-white to off white , crystalline powder , soluble in water in methanol and in alcohol.**[86]**

Pharmacokinetic data

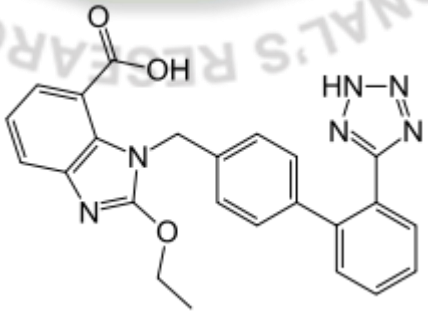
Protein binding 96.7%

Metabolism Hepatic glucuronidation

Half-life 10-11 hours

Excretion Renal and biliary

Candesartan[87]



Systematic (IUPAC) name 2-ethoxy-1-({4-[2-(2*H*-1,2,3,4-tetrazol-5-yl)phenyl]phenyl}methyl)-1*H*-1,3-benzodiazole-6-carboxylic acid

Chemical data

Formula $C_{24}H_{20}N_6O_3$

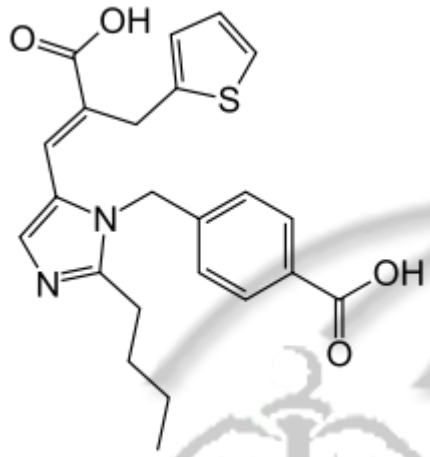
Mol. mass 440.45

Solubility profile:-practically soluble in water and soluble in methanol.**[88]**

Pharmacokinetic data

Bioavailability 15% (candesartan cilexetil)
Metabolism Candesartan cilexetil:
intestinal wall; candesartan:
hepatic (CYP2C9) Half-life 5.1–10.5 hours
Excretion Renal 33%, faecal 67%

Eprosartan[89]



Systematic (IUPAC) name 4-({2-butyl-5-[2-carboxy-2-(thiophen-2-ylmethyl)eth-1-en-1-yl]-1*H*-imidazol-1-yl}methyl)benzoic acid

Chemical data

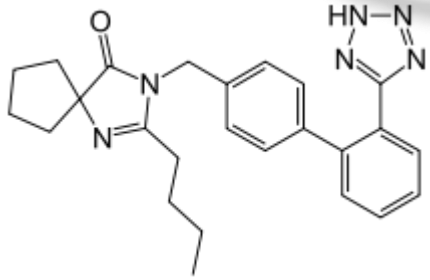
Formula $\mathbf{C_{23}H_{24}N_2O_4S}$
Mol. mass Eprosartan mesylate: 520.625 g/mol

SOLUBILITY PROFILE:-experiment water solubility=imuble (mesylate form)**[90]**

Pharmacokinetic data

Bioavailability 15% (Eprosartan mesylate)
Metabolism not metabolized
Half-life 5 to 9 hours
Excretion Renal 10%, biliary 90%.

Irbesartan[91]



Systematic (IUPAC) name 2-butyl-3-({4-[2-(2*H*-1,2,3,4-tetrazol-5-yl)phenyl]phenyl}methyl)-1,3-diazaspiro[4.4]non-1-en-4-one

Chemical data

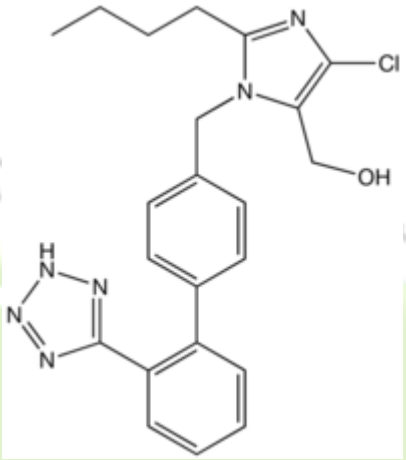
Formula $\mathbf{C_{25}H_{28}N_6O}$
Mol. mass 428.53

Solubility profile:-white to off white crystalline powder, slightly soluble in alcohol and in methlene chloride, practically soluble in water**[92,93]**

Pharmacokinetic data

Bioavailability 60–80%
Metabolism Hepatic
Half-life 11–15 hours
Excretion Renal 20%, faecal 65%

Losartan[94]



Systematic (IUPAC) name (2-butyl-4-chloro-1-{[2'-(1*H*-tetrazol-5-yl)biphenyl-4-yl]methyl}-1*H*-imidazol-5-yl)methanol

Chemical data

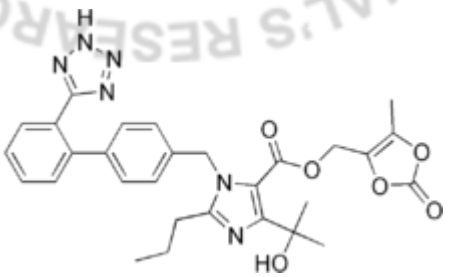
Formula $\mathbf{C_{22}H_{23}ClN_6O}$
Mol. mass 422.91

SOLUBILITY PROFILE:-white to off white powder , freely soluble in water , spiringly soluble in propopyl alcohol , slighty soluble in acetonitride**[95]**

Pharmacokinetic data

Bioavailability 25–35%
Metabolism Hepatic
Half-life 1.5–2 hours
Excretion Renal 13–25%, biliary 50–60%

Olmesartan[96]



Systematic (IUPAC) name (5-methyl-2-oxo-2*H*-1,3-dioxol-4-yl)methyl 4-(2-hydroxypropan-2-yl)-2-propyl-1-({4-[2-(2*H*-1,2,3,4-tetrazol-5-yl)phenyl]phenyl}methyl)-1*H*-imidazole-5-carboxylate

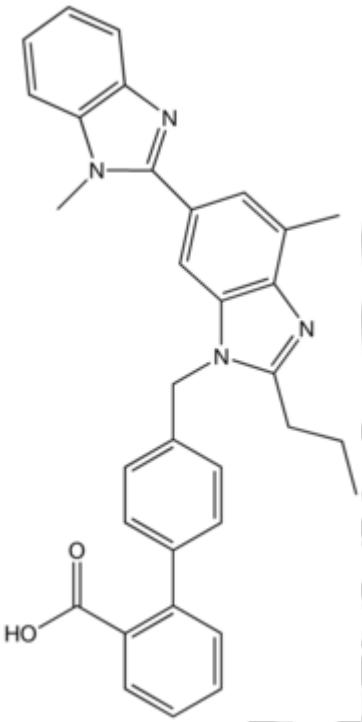
Chemical data

Formula $\mathbf{C_{29}H_{30}N_6O_6}$
Mol. mass 558.585 g/mol

Solubility Profile: - practically in soluble in water and spiringly soluble in methanol.**[97]**

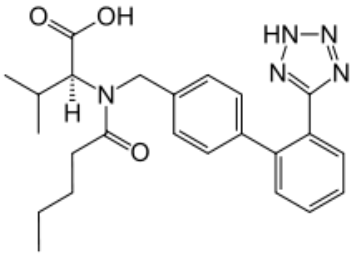
Pharmacokinetic data
Bioavailability 26%
Metabolism Hepatic (cannot be removed by hemodialysis)
Half-life 13 hours
Excretion Renal 40%, biliary 60%

Telmisartan[98]

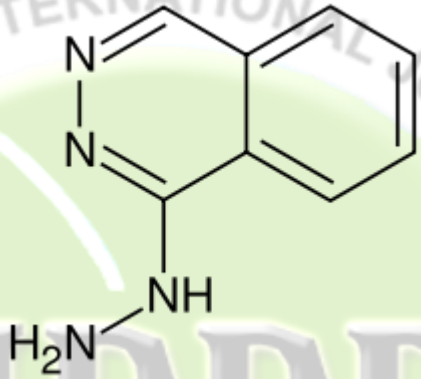


Systematic (IUPAC) name 2-(4-{[4-methyl-6-(1-methyl-1*H*-1,3-benzodiazol-2-yl)-2-propyl-1*H*-1,3-benzodiazol-1-yl]methyl}phenyl)benzoic acid
Chemical data
Formula $\mathbf{C_{33}H_{30}N_4O_2}$
Mol. mass 514.617 g/mol
Solubility Profile:-practically soluble in water,sparingly soluble in stong acid,soluble in strong base.**[99]**
Pharmacokinetic data
Bioavailability 42–100%
Protein binding ≥99.5%
Metabolism Minimal hepatic
Half-life 24 hours Excretion Faecal 97%

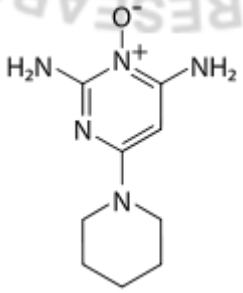
Valsartan[100]



Systematic (IUPAC) name (*S*)-3-methyl-2-[*N*-({4-[2-(2*H*-1,2,3,4-tetrazol-5-yl)phenyl]phenyl}methyl)pentanamido]butanoic acid
Chemical data
Formula $\mathbf{C_{24}H_{29}N_5O_3}$
Mol. mass 435.519 g/mol
Solubility Profile:- slightly soluble in water,soluble in alcohol**[101]**
Pharmacokinetic data
Bioavailability 25%
Protein binding 95%
Half-life 6 hours
Excretion Renal 30%, biliary 70%
HYDRALAZINE[102]



Systematic (IUPAC) name 1-hydrazinylphthalazine
Chemical data
Formula $\mathbf{C_8H_8N_4}$
Mol. mass 160.176 g/mol
Solubility Profile:-white to off white otaless , crystalline powder , helts at about 257 degree with decomposition , soluble in water , slighty soluble in alcohol , very slighty soluble in ether.**[103]**
Pharmacokinetic data
Bioavailability 26-55%
Metabolism Hepatic
Half-life 2-4 hours
Excretion Renal
Minoxidil[104]



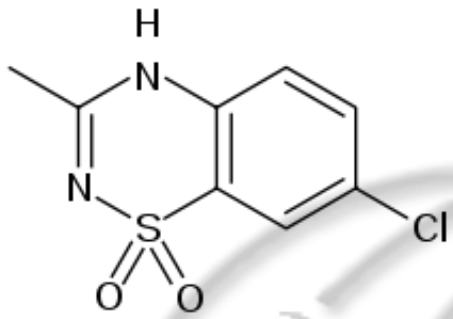
Systematic (IUPAC) name 6-piperidin-1-ylpyrimidine-2,4-diamine 3-oxide
Chemical data
Formula $\mathbf{C_9H_{15}N_5O}$
Mol. mass 209.251 g/mol

Solubility Profile:-white to off white , crystalline powder , helts in the approximate range of between 248 degree and 268 degree with decomposition. Soluble in alcohol and in propolene , spiringly soluble in water practically insoluble in chloroform in acetone , ethyl acetate and in hexane.**[105]**

Pharmacokinetic data

Metabolism Primarily hepatic
Half-life 4.2 hours
Excretion renal

Diazoxide[106]



Systematic (IUPAC) name 7-chloro-3-methyl-4*H*-1,2,4-benzothiadiazine 1,1-dioxide

Chemical data

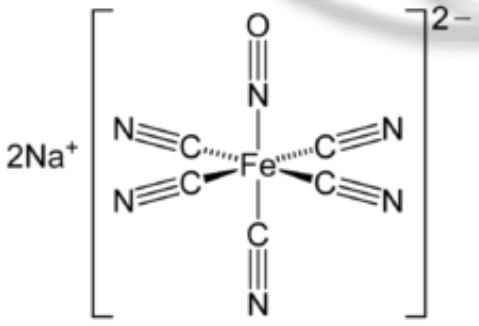
Formula $C_8H_7ClN_2O_2S$
Mol. mass 230.672 g/mol

Solubility Profile:-very slighty soluble in cold water. White or cream white crystals or crystalline powder , practically in soluble in water and in most organic solvents , very soluble in strong alkaline solutions, freely soluble in alimethylformamide.**[107]**

Pharmacokinetic data

Protein binding 90%
Metabolism Hepatic oxidation and sulfate conjugation
Half-life 21-45 hours
Excretion Renal

Nitroprusside[108]



IUPAC name[hide]
Sodium pentacyanonitrosylferrate(III)

Other names[hide]

Sodium nitroprusside
Sodium nitroferricyanide
Sodium pentacyanonitrosylferrate
SNP

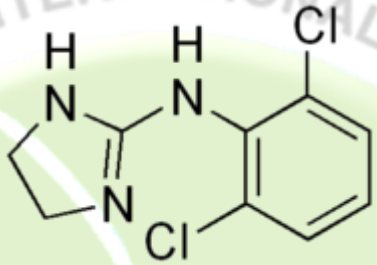
Properties

Molecular formula $Na_2[Fe(CN)_5NO]$
Molar mass 261.92 g/mol (anhydrous) 297.95 g/mol (dihydrate) Appearance red powder
Solubility in water good Solubility in ethanol soluble

Pharmacology

Routes of administration Intravenous
Metabolism Circulatory
Elimination
half-life 2 minutes (metabolites: several days)
Excretion Renal Legal status

Clonidine[109]



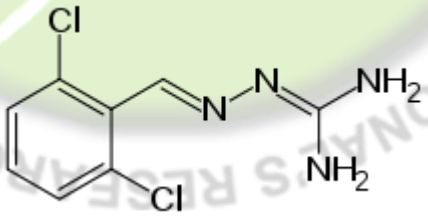
Systematic (IUPAC) name *N*-(2,6-dichlorophenyl)-4,5-dihydro-1*H*-imidazol-2-amine

Solubility Profile:-freely soluble in water and in ethanol (95 percent) , slighty soluble in chloroform, practically insoluble in ether.**[110]**

Pharmacokinetic data

Bioavailability 75-95%
Protein binding 20-40%
Metabolism Hepatic to inactive metabolites
Half-life 12-33 hours
Excretion urine (40-50%)

Guanabenz[111]



Systematic (IUPAC) name 2-(2,6-dichlorobenzylidene)hydrazinecarboximidamide

Chemical data

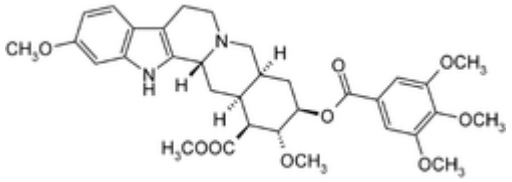
Formula $C_8H_8Cl_2N_4$
Mol. mass 231.081 g/mol

Solubility Profile:-white of almost white powder having not more thn a slight odour , spiringly soluble in water and in 0.1N hydrochloric acid , soluble in aicohol and propylenesycol.**[112]**

Pharmacokinetic data

Protein binding 90%
Half-life 6 hours

Reserpine[113]



Systematic (IUPAC) name *methyl-11,17α-dimethoxy-18β-[(3,4,5-trimethoxybenzoyl) oxy]-3β,20α-yohimban-16β-carboxylate*[2]
OR
methyl (1*R*,15*S*,17*R*,18*R*,19*S*,20*S*)-6,18-dimethoxy-17-[(3,4,5-trimethoxyphenyl)carbonyloxy]- 3,13-diazapentacyclo[11.8.0.0^{2,10}.0^{4,9}.0^{15,20}]henicosa-2(10),4(9),5,7-tetraene-19-carboxylate

Chemical data

Formula $\mathbf{C_{33}H_{40}N_2O_9}$
Mol. mass 608.68 g/mol

Solubility Profile:-white to pole buf to slightly yellowish odorless crystalline powder . daekness slowly in exposure to light but more rapidly when in solution , insoluble in water freely soluble in acetic acid and incloroform slightly soluble in benzene , very slightly soluble in alcohol and ether.**[114]**

Pharmacokinetic data

Bioavailability 50%
Metabolism gut/liver
Half-life phase 1 = 4.5h,
phase 2 = 271h,
average = 33h
Excretion 62% feces / 8% urine.

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