

PRODUCT MONOGRAPH

Pr QUINAPRIL

**Quinapril Tablets, USP
5 mg, 10 mg, 20 mg and 40 mg
(as Quinapril Hydrochloride)**

Angiotensin Converting Enzyme Inhibitor

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PART I: HEALTH PROFESSIONAL INFORMATION

^{Pr}QUINAPRIL

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PHARMACOLOGIC CLASSIFICATION

Angiotensin Converting Enzyme Inhibitor

ACTION AND CLINICAL PHARMACOLOGY

QUINAPRIL (quinapril hydrochloride) is a nonpeptide, nonsulphydryl inhibitor of angiotensin converting enzyme (ACE), which is used in the treatment of hypertension.

Angiotensin converting enzyme (ACE) is a peptidyl dipeptidase that catalyzes the conversion of angiotensin I to the vasoconstrictor angiotensin II. After absorption, quinapril is rapidly de-esterified to quinaprilat (quinapril diacid), its principal active metabolite. Its primary mode of action is to inhibit circulating and tissue ACE, thereby decreasing vasopressor activity and aldosterone secretion. Although the decrease in aldosterone is small, it results in a small increase in serum K⁺ (see PRECAUTIONS). Removal of angiotensin II negative feedback on renin secretion leads to increased plasma renin activity. Although quinapril hydrochloride had antihypertensive activity in all races studied, black hypertensive patients (usually a low-renin hypertensive population) had a smaller average response to ACE inhibitor monotherapy than non-black patients.

ACE is identical to kininase II. Thus, quinapril may interfere with the degradation of bradykinin, a potent peptide vasodilator. However, it is not known whether this system contributes to the therapeutic effects of quinapril hydrochloride.

The antihypertensive effect of quinapril outlasts its inhibitory effect on circulating ACE in animal studies. Tissue ACE inhibition more closely correlates with the duration of antihypertensive effects and this may be related to enzyme binding characteristics as shown for quinapril on purified tissue ACE from human kidney and heart.

Pharmacokinetics and Metabolism

Following oral administration of quinapril hydrochloride, peak plasma concentrations of quinapril occur within one hour. Based on the recovery of quinapril and its metabolites in urine, the extent of absorption is at least 60%. Following absorption, quinapril is de-esterified to its major active metabolite, quinaprilat (quinapril diacid) a potent ACE inhibitor, and to minor inactive metabolites. Quinapril has an apparent half-life in plasma of approximately one hour. Peak plasma quinaprilat

concentrations occur approximately 2 hours after an oral dose of quinapril hydrochloride. Quinaprilat is eliminated primarily by renal excretion and has an effective accumulation half-life of approximately 3 hours. Quinaprilat has an elimination half-life in plasma of approximately 2 hours with a prolonged terminal phase of 25 hours. Approximately 97% of either quinapril or quinaprilat circulating in plasma is bound to proteins.

Pharmacokinetic studies in patients with end-stage renal disease on chronic hemodialysis or continuous ambulatory peritoneal dialysis indicate that dialysis has little effect on the elimination of quinapril and quinaprilat.

The disposition of quinapril and quinaprilat in patients with renal insufficiency is similar to that in patients with normal renal function until creatinine clearance is 60 mL/min or less. With creatinine clearance less than 60 mL/min, peak and trough quinaprilat concentrations increase, apparent half-life increases, and time to steady state may be delayed. The elimination of quinaprilat may be reduced in elderly patients (>65 years) and in those with heart failure; this reduction is attributable to decrease in renal function (See DOSAGE and ADMINISTRATION). Quinaprilat concentrations are reduced in patients with alcoholic cirrhosis due to impaired de-esterification of quinapril.

The rate and extent of quinapril absorption are diminished moderately (approximately 25-30%) when quinapril hydrochloride tablets are administered during a high-fat meal. However, no effect on quinapril absorption occurs when taken during a regular meal.

Studies in rats indicate that quinapril and its metabolites do not cross the blood-brain barrier.

Pharmacodynamics

Administration of 10 to 40 mg of quinapril hydrochloride to patients with essential hypertension results in a reduction of both sitting and standing blood pressure with minimal effect on heart rate. Antihypertensive activity commences within one hour with peak effects usually achieved by 2 to 4 hours after dosing. Achievement of maximum blood pressure lowering effects may require 2 weeks of therapy in some patients. At the recommended doses, antihypertensive effects are maintained throughout the 24-hour dosing interval in most patients. While the dose response relationship is relatively flat, a dose of 40 mg was somewhat more effective at trough than 10-20 mg, and twice daily dosing tended to give a somewhat lower blood pressure than once daily dosing with the same total daily dose. The antihypertensive effect of quinapril hydrochloride was maintained during long-term therapy with no evidence of loss of effectiveness.

Hemodynamic assessments in patients with essential hypertension indicate that blood pressure reduction produced by quinapril is accompanied by a reduction in total peripheral resistance and renal vascular resistance with little or no change in heart rate and cardiac index. There was an increase in renal blood flow which was not significant. Little or no change in glomerular filtration rate or filtration fraction was observed.

Quinapril has been shown to reduce microalbuminuria in patients with essential hypertension independently of changes in systemic blood pressure.

When quinapril hydrochloride is given together with thiazide-type diuretics, the antihypertensive effects are approximately additive.

Administration of quinapril hydrochloride to patients with congestive heart failure (CHF) reduces peripheral vascular resistance, systolic and diastolic blood pressure, pulmonary capillary wedge pressure, and increases cardiac output. The onset of effects was observed within one hour and maximal effects occurred at 1.25 to 4 hours after administration of quinapril hydrochloride. Peak hemodynamic effects correlated well with peak plasma levels of quinaprilat (1 to 4 hours after administration).

Exercise tolerance was improved with quinapril hydrochloride therapy.

The effect of quinapril hydrochloride on survival in patients with heart failure has not been evaluated.

Therapeutic effects appear to be the same for elderly (>65 years of age) and younger adult patients given the same daily dosages, with no increase in adverse events in elderly patients.

The antihypertensive effect of angiotensin converting enzyme inhibitors is generally lower in black patients than in non-blacks.

Comparative Bioavailability Studies

A single-dose, randomized, crossover bioequivalence study was performed in normal healthy male volunteers (n=24) under fasting conditions on quinapril tablets using Pro Doc Ltée QUINAPRIL 40 mg tablets versus the reference product, PrACCUPRIL™ 40 mg Tablets, by Pfizer Canada Inc. The bioavailability data calculated for the QUINAPRIL 40 mg tablets in comparison to the PrACCUPRIL™ 40 mg tablets are tabulated below:

Quinapril (1 x 40 mg Tablets) From measured data Geometric Mean Arithmetic Mean (CV %)				
Parameter	Test*	Reference†	% Ratio of Geometric Means	Confidence Interval (90%)
AUC _T (ng·h/mL)	266.55 275.57 (25.1)	256.65 272.80 (35.5)	103.86	96.90-111.31
AUC _I (ng·h/mL)	273.66 282.63 (24.8)	264.67 281.22 (35.1)	103.40	96.60-110.67
C _{max} (ng/mL)	355.84 379.47 (35.4)	312.32 356.92 (51.1)	113.93	98.91-131.25
T _{max} [§] (h)	0.50 (0.33 – 1.00)	0.58 (0.33 – 1.50)		
T _{1/2} ^ε (h)	0.79 (25.9)	0.90 (54.5)		

*QUINAPRIL (quinapril hydrochloride), Pro Doc Ltée, Laval, Canada

†ACCUPRIL™ (quinapril hydrochloride), Pfizer Canada Inc. Kirkland, Québec, Canada was purchased in Canada

§ Expressed as the median (range) only

ε Expressed as the arithmetic mean (CV%) only

INDICATIONS AND CLINICAL USE

Hypertension

QUINAPRIL (quinapril hydrochloride) is indicated in the treatment of essential hypertension. It is usually administered in association with other drugs, particularly thiazide diuretics.

In using QUINAPRIL, consideration should be given to the risk of angioedema (see WARNINGS).

QUINAPRIL should normally be used in those patients in whom treatment with a diuretic or a beta-blocker was found ineffective or has been associated with unacceptable adverse effects. QUINAPRIL can also be tried as an initial agent in those patients in whom use of diuretics and/or beta-blockers is contraindicated or in patients with medical conditions in which these drugs frequently cause serious adverse effects.

The safety and efficacy of QUINAPRIL in renovascular hypertension has not been established; therefore, use in this condition is not recommended.

Congestive Heart Failure

QUINAPRIL is indicated in the treatment of congestive heart failure as adjunctive therapy when added to diuretics and/or digitalis glycosides.

Treatment with QUINAPRIL should be initiated under close medical supervision.

CONTRAINDICATIONS

QUINAPRIL is contraindicated :

- in patients who are hypersensitive to the drug or any ingredient in the formulation. QUINAPRIL contains lactose.
- in patients with a history of angioedema related to previous treatment with an ACE inhibitor.
- in women who are pregnant, intend to become pregnant, or of childbearing potential who are not using adequate contraception (see WARNINGS and ADVERSE REACTIONS).
- in breast-feeding women.
- with aliskiren-containing medicines in patients with diabetes mellitus (type 1 or type 2) or with moderate to severe renal impairment (GFR < 60 mL/min/1.73m²).

WARNINGS

Serious Warnings and Precautions

When used in pregnancy, angiotensin converting enzyme (ACE) inhibitors can cause injury or even death of the developing fetus. When pregnancy is detected, QUINAPRIL should be discontinued as soon as possible.

Aliskiren-containing medicines

Dual blockade of the Renin-Angiotensin System (RAS): There is evidence that co-administration of angiotensin converting enzyme inhibitors (ACE inhibitors), such as QUINAPRIL, or of angiotensin receptor antagonists (ARBs) with aliskiren, increases the risk of hypotension, syncope, stroke, hyperkalemia and deterioration of renal function, including renal failure, in patients with diabetes mellitus (type 1 or type 2) and/or moderate to severe renal impairment (GFR < 60 mL/min/1.73 m²). Therefore, the use of QUINAPRIL in combination with aliskiren-containing drugs is contraindicated in these patients (see CONTRAINDICATIONS). Further, co-administration of ACE inhibitors, including QUINAPRIL, with other agents blocking the RAS, such as ARBs or aliskiren-containing drugs, is generally not recommended in other patients, since such treatment has been associated with an increased incidence of severe hypotension, renal failure, and hyperkalemia.

Head and Neck Angioedema

Head and neck angioedema has been reported in patients treated with quinapril hydrochloride. Angioedema associated with laryngeal involvement may be fatal. If laryngeal stridor or angioedema of the face, tongue, or glottis occurs, QUINAPRIL should be discontinued immediately, the patient treated appropriately in accordance with accepted medical care, and carefully observed until the swelling disappears. In instances where swelling is confined to the face and lips, the condition generally resolves without treatment, although antihistamines may be useful in relieving symptoms. Where there is involvement of the tongue, glottis or larynx, likely to cause airway obstruction, appropriate therapy (including but not limited to 0.3 to 0.5 mL of subcutaneous epinephrine solution 1:1000) should be administered promptly (See ADVERSE REACTIONS).

The incidence of angioedema during ACE inhibitor therapy has been reported to be higher in black than in non-black patients.

Patients taking concomitant mTOR inhibitor (e.g. temsirolimus) or concomitant DPP-IV inhibitor (e.g. sitagliptin) therapy may be at increased risk for angioedema. Caution should be used when either initiating ACE inhibitor therapy in patients already taking an mTOR or DPP-IV inhibitor or vice versa.

Patients with a history of angioedema unrelated to ACE inhibitor therapy may be at increased risk of angioedema while receiving an ACE inhibitor (See CONTRAINDICATIONS).

Intestinal Angioedema

Intestinal angioedema has been reported in patients treated with ACE inhibitors. These patients presented with abdominal pain (with or without nausea or vomiting); in some cases there was no prior history of facial angioedema and C-1 esterase levels were normal. The angioedema was diagnosed by procedures including abdominal CT scan or ultrasound, or at surgery, and symptoms resolved after stopping the ACE inhibitor. Intestinal angioedema should be included in the differential diagnosis of patients on ACE inhibitors presenting with abdominal pain.

Hypotension

Symptomatic hypotension has occurred after administration of quinapril hydrochloride, usually after the first or second dose or when the dose was increased. It is more likely to occur in patients who are volume depleted by diuretic therapy, dietary salt restriction, dialysis, diarrhea, or vomiting. In patients with ischemic heart or cerebrovascular disease, an excessive fall in blood pressure could result in a myocardial infarction or cerebrovascular accident (See ADVERSE REACTIONS). Because of the potential fall in blood pressure in these patients, therapy with QUINAPRIL should be started under close medical supervision (see DOSAGE AND ADMINISTRATION). Such patients should be followed closely for the first weeks of treatment and whenever the dose of QUINAPRIL is increased. In patients with severe congestive heart failure, with or without associated renal insufficiency, excessive hypotension has been observed and may be associated with oliguria and/or progressive azotemia, and rarely with acute failure and/or death.

If hypotension occurs, the patient should be placed in supine position and, if necessary, receive an intravenous infusion of 0.9% sodium chloride. A transient hypotensive response is not a contraindication to further doses which usually can be given without difficulty once the blood pressure has increased after volume expansion. However, lower doses of QUINAPRIL and/or reduced concomitant diuretic therapy should be considered.

Neutropenia/Agranulocytosis

Agranulocytosis and bone marrow depression have been caused by ACE inhibitors. Agranulocytosis did occur during quinapril hydrochloride treatment in one patient with a history of neutropenia during previous captopril therapy. Periodic monitoring of white blood cell counts should be considered, especially in patients with collagen vascular disease and/or renal disease.

Use in Pregnancy

Quinapril is contraindicated in pregnancy (see CONTRAINDICATIONS and ADVERSE REACTIONS). ACE inhibitors can cause fetal and neonatal morbidity and mortality when administered to pregnant women. Several dozen cases have been reported in the world literature. When pregnancy is detected, quinapril should be discontinued as soon as possible.

The use of ACE inhibitors during the second and third trimesters of pregnancy has been associated with fetal and neonatal injury including hypotension, neonatal skull hypoplasia, anuria, reversible or irreversible renal failure, and death. Oligohydramnios has also been reported, presumably resulting from decreased fetal renal function; oligohydramnios in this setting has been associated with fetal limb contractures, craniofacial deformation, and hypoplastic lung development.

Prematurity, and patent ductus arteriosus and other structural cardiac malformations, as well as neurologic malformations have also been reported, following exposure in the first trimester of pregnancy.

Infants with a history of *in utero* exposure to ACE inhibitors should be closely observed for hypotension, oliguria, and hyperkalemia. If oliguria occurs, attention should be directed toward support of blood pressure and renal perfusion. Exchange transfusion or dialysis may be required as a means of reversing hypotension and/or substituting for impaired renal function, however; limited experience with those procedures has not been associated with significant clinical benefit.

Hemodialysis and peritoneal dialysis have little effect on the elimination of quinapril and quinaprilat.

If oligohydramnios is observed, a non-stress test (NST), and/or a biophysical profiling (BPP) may be appropriate, depending upon the week of pregnancy. If concerns regarding fetal well-being still persist, a contraction stress testing (CST) should be considered. Patients and

physicians should be aware, however, that oligohydramnios may not appear until after the fetus has sustained irreversible injury.

Animal Data: No fetotoxic or teratogenic effects were observed in rats at doses as high as 300 mg/kg/day (180 times the maximum daily human dose), despite maternal toxicity at 150 mg/kg/day. Offspring body weights were reduced in rats treated late in gestation and during lactation with doses of 25 mg/kg/day or more. Quinapril hydrochloride was not teratogenic in rabbits; however, maternal and embryo toxicity were seen in some rabbits at 1 mg/kg/day.

No adverse effects on fertility or reproduction were observed in rats at dose levels up to 100 mg/kg/day (60 times the maximum daily human dose).

Nursing Women

The presence of concentrations of ACE inhibitor has been reported in human milk. The use of QUINAPRIL is contraindicated during breast-feeding

PRECAUTIONS

Renal Impairment

The use of ACE inhibitors, including quinapril, or ARBs with aliskiren-containing drugs is contraindicated in patients with moderate to severe renal impairment (GFR < 60 mL/min/1.73m²). (See CONTRAINDICATIONS and DRUG INTERACTIONS, Aliskiren-containing medicines).

As a consequence of inhibiting the renin-angiotensin-aldosterone system, changes in renal function have been seen in susceptible individuals. In patients whose renal function may depend on the activity of the renin-angiotensin-aldosterone system, such as patients with bilateral renal artery stenosis, unilateral renal artery stenosis to a solitary kidney, or severe congestive heart failure, treatment with agents that inhibit this system has been associated with oliguria, progressive azotemia, and rarely, acute renal failure and/or death. In susceptible patients, concomitant diuretic use may further increase risk (See ADVERSE REACTIONS and DOSAGE AND ADMINISTRATION).

Use of QUINAPRIL should include appropriate assessment of renal function (See ADVERSE REACTIONS and DOSAGE AND ADMINISTRATION).

Anaphylactoid Reactions during Membrane Exposure

Anaphylactoid reactions have been reported in patients dialysed with high-flux membranes (e.g.: polyacrylonitrile [PAN]) and treated concomitantly with an ACE inhibitor. Dialysis should be stopped immediately if symptoms such as nausea, abdominal cramps, burning, angioedema, shortness of breath and severe hypotension occur. Symptoms are not relieved by

antihistamines. In these patients consideration should be given to using a different type of dialysis membrane or a different class of antihypertensive agents.

Anaphylactoid Reactions during LDL Apheresis

Rarely, patients receiving ACE inhibitors during low density lipoprotein apheresis with dextran sulfate have experienced life-threatening anaphylactoid reactions. These reactions were avoided by temporarily withholding the ACE inhibitor therapy prior to each apheresis.

Anaphylactoid Reactions during Desensitization

There have been isolated reports of patients experiencing sustained life threatening anaphylactoid reactions while receiving ACE inhibitors during desensitizing treatment with hymenoptera (bees, wasps) venom. In the same patients, these reactions have been avoided when ACE inhibitors were temporarily withheld for at least 24 hours, but they have reappeared upon inadvertent re-challenge to an ACE inhibitor.

Hyperkalemia and Potassium-Sparing Diuretics

Elevated serum potassium (greater than 5.7 mEq/L) was observed in approximately 2% of patients receiving quinapril hydrochloride. In most cases these were isolated values which resolved despite continued therapy. Hyperkalemia was a cause of discontinuation of therapy in less than 0.1% of hypertensive patients. Risk factors for the development of hyperkalemia may include renal insufficiency, diabetes mellitus, and the concomitant use of agents to treat hypokalemia (See PRECAUTIONS: Drug Interactions and ADVERSE REACTIONS).

Hypoglycemia and Diabetes

ACE inhibitors may reduce insulin resistance and may lead to hypoglycemia in diabetic patients on insulin or oral hypoglycemic agents; closer monitoring of diabetic patients may be required.

Valvular Stenosis

There is concern on theoretical grounds that patients with aortic stenosis might be at particular risk of decreased coronary perfusion when treated with vasodilators because they do not develop as much afterload reduction.

Surgery/Anaesthesia

In patients undergoing major surgery or during anaesthesia with agents that produce hypotension, quinapril hydrochloride will block angiotensin II formation secondary to compensatory renin release. If hypotension occurs and is considered to be due to this mechanism, it can be corrected by volume expansion.

Patients with Impaired Liver Function

Hepatitis (hepatocellular and/or cholestatic), elevations of liver enzymes and/or serum bilirubin have occurred during therapy with other ACE inhibitors in patients with or without pre-existing liver abnormalities. In most cases the changes were reversed on discontinuation of the drug.

Elevations of liver enzymes and/or serum bilirubin have been reported for quinapril hydrochloride (See ADVERSE REACTIONS). Should the patient receiving QUINAPRIL experience any unexplained symptoms particularly during the first weeks or months of treatment, it is recommended that a full set of liver function tests and any other necessary investigation be carried out. Discontinuation of QUINAPRIL should be considered when appropriate.

There are no adequate studies in patients with cirrhosis and/or liver dysfunction. QUINAPRIL should be used with particular caution in patients with pre-existing liver abnormalities. In such patients baseline liver function tests should be obtained before administration of the drug and close monitoring of response and metabolic effects should apply.

Quinapril, when combined with a diuretic should be used with caution in patients with impaired hepatic function or progressive liver disease, since minor alterations of fluid and electrolyte balance may precipitate hepatic coma. The metabolism of quinapril to quinaprilat is normally dependent upon hepatic esterase. Quinaprilat concentrations are reduced in patients with alcoholic cirrhosis due to impaired deesterification of quinapril.

Cough

Cough has been reported with the use of ACE inhibitors, including quinapril. Characteristically, the cough is dry and persistent and usually disappears only after withdrawal or lowering of the dose of quinapril hydrochloride. ACE inhibitor-induced cough should be considered as part of the differential diagnosis of the cough.

Use in Children

The safety and effectiveness of quinapril hydrochloride in children have not been established, therefore use in this age group is not recommended.

Use in the Elderly

Of the total number of subjects in clinical studies of quinapril hydrochloride, 21% were 65 and over. (There was no distinction between patients over 65 or over 75 years.) No overall differences in safety or effectiveness were observed between these subjects and younger subjects, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.

This drug is known to be substantially excreted by the kidney, and the risk of toxic reactions to this drug may be greater in patients with impaired renal function. Because elderly patients are more likely to have decreased renal function, care should be taken in dose selection, and it may be useful to monitor renal function (see ADVERSE REACTIONS and DOSAGE ADMINISTRATION).

Elderly patients exhibited increased area under the plasma concentration time curve and peak levels for quinaprilat compared to values observed in younger patients; this appeared to relate to decreased renal function rather than to age itself.

Driving and Operating Machinery

The ability to engage in activities such as operating machinery or operating a motor vehicle may be impaired, especially when initiating quinapril therapy.

Drug Interactions

Concomitant Diuretic Therapy: Patients concomitantly taking ACE inhibitors and diuretics, and especially those, in whom diuretic therapy was recently instituted, may occasionally experience an excessive reduction of blood pressure after initiation of therapy. The possibility of hypotensive effects after the first dose of quinapril hydrochloride can be minimized by either discontinuing the diuretic or increasing the salt intake (except in patients with heart failure), prior to initiation of treatment with quinapril hydrochloride. If it is not possible to discontinue the diuretic, the starting dose of quinapril hydrochloride should be reduced and the patient should be closely observed for several hours following initial dose and until blood pressure has stabilized. (See WARNINGS, and DOSAGE and ADMINISTRATION).

Agents Increasing Serum Potassium: Since quinapril hydrochloride decreases aldosterone production, elevation of serum potassium may occur. Potassium sparing diuretics such as spironolactone, triamterene or amiloride, or potassium supplements should be given only for documented hypokalemia and with caution and frequent monitoring of serum potassium, since they may lead to a significant increase in serum potassium. Salt substitutes which contain potassium should also be used with caution.

Aliskiren-containing medicines: The combination of QUINAPRIL with aliskiren-containing medicines is contraindicated in patients with diabetes mellitus (type 1 or type 2) or with moderate to severe renal impairment ($\text{GFR} < 60 \text{ mL/min/1.73 m}^2$) and is not recommended in other patients (see CONTRAINDICATIONS; WARNINGS).

Agents Causing Renin Release: The antihypertensive effect of quinapril hydrochloride is augmented by antihypertensive agents that cause renin release (e.g. diuretics).

Agents Affecting Sympathetic Activity: Agents affecting sympathetic activity (e.g. ganglionic blocking agents or adrenergic neuron blocking agents) may be used with caution. Beta-adrenergic blocking drugs add some further antihypertensive effect to quinapril hydrochloride.

Tetracycline: Concomitant administration of tetracycline with quinapril hydrochloride reduced the absorption of tetracycline in healthy volunteers (by 28-37%) due to the presence of magnesium carbonate as an excipient in the formulation. This interaction should be considered with concomitant use of QUINAPRIL and tetracycline or other drugs which interact with magnesium.

Lithium: *As with* other drugs which eliminate sodium, the lithium elimination may be reduced. Therefore, the serum lithium levels should be monitored carefully if lithium salts are to be administered.

Non-steroidal anti-inflammatory drugs (NSAIDs) including selective cyclooxygenase-2 inhibitors (COX-2 inhibitors): In patients who are elderly, volume-depleted (including those on diuretic therapy), or with compromised renal function, co-administration of NSAIDs, including selective COX-2 inhibitors, with ACE inhibitors, including quinapril, may result in deterioration of renal function, including possible acute renal failure. These effects are usually reversible. Monitor renal function periodically in patients receiving quinapril and NSAID therapy. The antihypertensive effect of ACE inhibitors, including quinapril may be attenuated by NSAIDs.

Agents that inhibit mTOR or DPP-IV: Patients taking concomitant mTOR inhibitor (e.g. temsirolimus, everolimus or sirolimus) or concomitant DPP-IV inhibitor (e.g. sitagliptin) therapy may be at increased risk for angioedema. Caution should be used when either initiating ACE inhibitor therapy in patients already taking an mTOR inhibitor or a DPP-IV inhibitor or vice versa.

Other Agents: In single dose pharmacokinetic studies, no important changes in pharmacokinetic parameters were observed when quinapril hydrochloride was used concomitantly with propranolol, hydrochlorothiazide, digoxin, or cimetidine. No change in prothrombin time occurred when quinapril hydrochloride and warfarin were given together.

ADVERSE REACTIONS

Hypertension

Quinapril hydrochloride monotherapy has been evaluated for safety in 2005 hypertensive patients enrolled in placebo-controlled clinical trials. These trials included 313 elderly patients. There was no increase in the incidence of adverse events in elderly patients given the same daily dosages. Quinapril hydrochloride has been evaluated for long-term safety in over 1100 patients treated for one year or more. Adverse events were usually mild and transient in nature.

The most serious adverse event was angioedema (0.1%). Renal insufficiency (1 case), agranulocytosis (1 case) and mild azotemia (2 cases in CHF patients) have been reported. Myocardial infarction and cerebrovascular accident occurred, possibly secondary to excessive hypotension in high risk patients (see WARNINGS and PRECAUTIONS).

The most frequent adverse events in controlled clinical trials were headache (8.1%), dizziness (4.1%), cough (3.2%), fatigue (3.2%), rhinitis (3.2%), nausea and/or vomiting (2.3%), and abdominal pain (2.0%).

Discontinuation of therapy because of adverse events was required in 4.7% of patients treated with quinapril hydrochloride in placebo controlled trials.

Congestive Heart Failure (CHF)

At least one adverse event was experienced by 605 (55%) of the 1108 patients with congestive heart failure. Five hundred twenty five of these patients were evaluated for safety in controlled clinical trials. The frequencies of adverse events were similar for both sexes as well as for younger (<65 years) and older (>65 years) patients.

The most serious non-fatal adverse events/reactions were angioedema (0.1%), chest pain of unknown origin (0.8%), angina pectoris (0.4%), hypotension (0.1%), and impaired renal function (see PRECAUTIONS). Myocardial infarct, and cerebrovascular accident occurred (see WARNINGS). Rare cases of eosinophilic pneumonitis have been reported. Hepatitis or hepatic failure have rarely been observed with other ACE inhibitors.

The most frequent adverse events in controlled clinical trials were dizziness (11.2%), cough (7.6%), chest pain (6.5%), dyspnea (5.5%), fatigue (5.1%), and nausea/vomiting (5.0%).

Discontinuation due to adverse events in controlled clinical trials was required for 41 (8.0%) patients. Hypotension (0.8%) and cough (0.8%) were the most common reasons for withdrawal.

Adverse events occurring in $\geq 0.5\%$ of 2005 hypertensive patients treated with quinapril hydrochloride monotherapy and in 525 patients with congestive heart failure treated with quinapril hydrochloride as adjunctive therapy, in controlled clinical trials, are presented in the table below:

**QUINAPRIL HYDROCHLORIDE: Adverse Events in Patients ($\geq 0.5\%$) with Hypertension
and Congestive Heart Failure in Controlled Clinical Trials
(Irrespective of Causal Relationship)
(Page 1 of 2)**

	Hypertension ¹ % Patients (N=2005)	Congestive Heart Failure ² % Patients (N=525)
BODY AS A WHOLE		
Chest Pain	1.2	6.5
Fatigue	3.2	5.1
Headache	8.1	3.2
Back Pain	1.3	1.7
Asthenia	1.0	1.7
Peripheral Edema	0.9	1.5
Generalized Edema	0.7	0.2
CARDIOVASCULAR SYSTEM		
Hypotension	1.0	3.4
Angina Pectoris	0.2	2.3
Palpitation	0.4	1.3
Tachycardia	0.2	1.1
Myocardial infarct		0.6
Arrhythmia	0.1	0.6
DIGESTIVE SYSTEM		
Nausea and/or vomiting	2.3	5.0
Abdominal pain	2.0	2.5
Diarrhea	1.9	3.4
Dyspepsia	1.9	1.5
Dry mouth or throat	0.4	0.8
MUSCULOSKELETAL SYSTEM		
Myalgia	1.7	2.9

¹ QUINAPRIL HYDROCHLORIDE monotherapy

² QUINAPRIL HYDROCHLORIDE as adjunctive therapy to diuretic and/or digitalis.

**QUINAPRIL HYDROCHLORIDE: Adverse Events in Patients ($\geq 0.5\%$) with Hypertension
and Congestive Heart Failure in Controlled Clinical Trials
(Irrespective of Causal Relationship)
(Page 2 of 2)**

	Hypertension ¹ % Patients (N=2005)	Congestive Heart Failure ² % Patients (N=525)
NERVOUS SYSTEM		
Dizziness	4.1	11.2
Insomnia	1.3	1.1
Paresthesia	1.0	1.3
Nervousness	1.0	0.2
Somnolence	0.9	0.6
Syncope	0.3	0.6
Vertigo	0.4	0.8
Depression	0.6	1.0
RESPIRATORY		
Cough	3.2	7.6
Dyspnea	0.9	5.5
Hemoptysis	-	0.6
Rhinitis	3.2	2.5
SKIN AND APPENDAGES		
Rash	0.6	1.9
Sweating increased	0.8	1.1
Pruritus	0.6	0.4
UROGENITAL SYSTEM		
Impotence	0.5	0.2
SPECIAL SENSES		
Amblyopia	0.3	1.3
Unusual Taste	0.1	0.8
Abnormal Vision	0.1	0.6
Taste Loss	0.2	0.6

¹ QUINAPRIL HYDROCHLORIDE monotherapy

² QUINAPRIL HYDROCHLORIDE as adjunctive therapy to diuretic and/or digitalis.

Adverse events occurring in <0.5% of patients with hypertension or congestive heart failure include:

Body as a whole:	Allergy, face edema, chill, weight increase, dehydration
Cardiovascular:	Vasodilatation, cerebrovascular accident, heart failure, ventricular tachycardia, atrial flutter
Digestive System:	Constipation, tongue edema, GI hemorrhage, anorexia, bloody stools
Hemic and Lymphatic System:	Anemia, including hemolytic anemia, agranulocytosis
Nervous System:	Confusion, amnesia, anxiety, arthralgia
Musculoskeletal System:	Arthritis
Respiratory System:	Asthma, hoarseness
Skin and Appendages:	Dermatitis, urticaria, eczema, Stevens-Johnson syndrome
Urogenital System:	Dysuria, polyuria, impaired renal function
Special Senses:	Tinnitus
Laboratory Deviations:	Hematuria, WBC decreased, elevated BUN, hyperglycemia, azotemia

Clinical adverse experiences probably, possibly, or definitely related, or of uncertain relationship to therapy occurring in 0.5% to $\leq 1.0\%$ of the patients treated with quinapril (with or without concomitant diuretic) in controlled or uncontrolled clinical trials and less frequent events seen in clinical trials or post-marketing experience (indicated by a *) included:

Body as a Whole:	anaphylactoid reaction*; photosensitivity reaction*
Cardiovascular:	postural hypotension*, syncope*, vasodilation
Gastrointestinal:	flatulence, pancreatitis*
Hemic and Lymphatic:	thrombocytopenia*
Integumentary:	alopecia*, exfoliative dermatitis*, pemphigus*
Urogenital:	urinary tract infection
Congenital and familial/ genetic disorders:	See CONTRAINDICATIONS, WARNINGS and Use In Pregnancy
Other:	arthralgia, edema (peripheral and generalized), hemolytic anemia*

Clinical Laboratory Test Findings

Hematology: (see WARNINGS)
Hyperkalemia: (see PRECAUTIONS)

Creatinine and Blood Urea Nitrogen: Increases (>1.25 times the upper limit of normal) in serum creatinine and blood urea nitrogen were observed in 2% and 2%, respectively, of patients treated with quinapril hydrochloride alone. Increases are more likely to occur in patients receiving concomitant diuretic therapy than in those on quinapril hydrochloride alone (See PRECAUTIONS). These increases often reversed on continued therapy. In controlled studies of heart failure, increases in blood urea nitrogen and serum creatinine were observed in

11% and 8%, respectively, of patients treated with quinapril hydrochloride. Most often these patients were receiving diuretics with or without digitalis.

Hepatic: Elevations of liver enzymes and/or serum bilirubin have occurred (See PRECAUTIONS).

SYMPTOMS AND TREATMENT OF OVERDOSAGE

No data are available regarding overdosage of quinapril hydrochloride in humans. The most likely clinical manifestation would be symptoms attributable to severe hypotension, which should be normally treated by intravenous volume expansion with 0.9% sodium chloride. Hemodialysis and peritoneal dialysis have little effect on the elimination of quinapril and quinaprilat.

For management of a suspected overdose, contact your regional Poison Control Centre immediately.

DOSAGE AND ADMINISTRATION

Dosage of QUINAPRIL (quinapril hydrochloride) must be individualized.

Hypertension

Initiation of therapy requires consideration of recent antihypertensive drug treatment, the extent of blood pressure elevation and salt restriction. The dosage of other antihypertensive agents being used with QUINAPRIL may need to be adjusted.

Monotherapy:

The recommended initial dose of QUINAPRIL in patients not on diuretics is 10 mg once daily. An initial dose of 20 mg once daily can be considered for patients without advanced age, renal impairment, or concomitant heart failure and who are not volume depleted (see WARNINGS: Hypotension). Dosage should be adjusted according to blood pressure response, generally at intervals of two to four weeks. A dose of 40 mg daily should not be exceeded.

In some patients treated once daily, the antihypertensive effect may diminish towards the end of the dosing interval. This can be evaluated by measuring blood pressure just prior to dosing to determine whether satisfactory control is being maintained for 24 hours. If it is not, either twice daily administration with the same total daily dose, or an increase in dose should be considered. If blood pressure is not controlled with QUINAPRIL alone, a diuretic may be added. After the addition of a diuretic, it may be possible to reduce the dose of QUINAPRIL.

Concomitant Diuretic Therapy: Symptomatic hypotension occasionally may occur following the initial dose of QUINAPRIL and is more likely in patients who are currently being treated with a diuretic. The diuretic should, if possible, be discontinued for two to three days before beginning therapy with QUINAPRIL to reduce the likelihood of hypotension (See WARNINGS). If the diuretic cannot be discontinued, an initial dose of 5 mg QUINAPRIL

should be used with careful medical supervision for several hours and until blood pressure has stabilized. The dosage of QUINAPRIL should subsequently be titrated (as described above) to the optimal response.

Dosing Adjustment in Renal Impairment: See PRECAUTIONS and ADVERSE REACTIONS section for use in hemodialysis patients.

Starting doses should be reduced according to the following guidelines:

Creatinine Clearance (mL/min)	Maximum Recommended Initial Dose (mg)
>60	10
30-60	5
10-30	2.5
<10	Insufficient data for dosage recommendation

Patients should subsequently have dosage titrated (as described above) to the optimal response.

Dosage in the Elderly (over 65 years): The recommended initial dosage of QUINAPRIL is 10 mg once daily (depending on renal function), followed by titration (as described above) to the optimal response.

Congestive Heart Failure

QUINAPRIL is indicated as adjunctive therapy to diuretics, and/or cardiac glycosides. Therapy should be initiated under close medical supervision. Blood pressure and renal function should be monitored, both before and during treatment with QUINAPRIL, because severe hypotension and, more rarely, consequent renal failure have been reported (see WARNINGS and PRECAUTIONS).

Initiation of therapy requires consideration of recent diuretic therapy and the possibility of severe salt/volume depletion. If possible, the dose of diuretic should be reduced before beginning treatment, to reduce the likelihood of hypotension. Serum potassium should also be monitored (see PRECAUTIONS, Drug Interactions).

The recommended starting dose is 5 mg once daily, to be administered under close medical supervision to determine the initial effect on blood pressure. After the initial dose, the patient should be observed for at least two hours, or until the pressure has stabilized for at least an additional hour (See WARNINGS, Hypotension). This dose may improve symptoms of heart failure, but increases in exercise duration have generally required higher doses. Therefore, if the initial dosage of QUINAPRIL is well tolerated or after effective management of symptomatic hypotension following initiation of therapy, the dose should then be increased gradually to 10 mg once daily, then 20 mg once daily, and to 40 mg *per* day given in 2 equally divided doses, depending on the patient's response. The maximum daily dose is 40 mg.

The dose titration may be done at weekly intervals, as indicated by the presence of residual signs or symptoms of heart failure.

Renal Impairment or Hyponatremia: Kinetic data indicate that quinapril hydrochloride elimination is dependent on the level of renal function. The recommended initial dose of QUINAPRIL is 5 mg in patients with a creatinine clearance of 30 to 60 mL/min and 2.5 mg in patients with a creatinine clearance of 10 to 30 mL/min. There is insufficient data for dosage recommendation in patients with a creatinine clearance less than 10 mL/min. If the initial dose is well tolerated, QUINAPRIL may be administered the following day as a twice daily regimen. In the absence of excessive hypotension or significant deterioration of renal function, the dose may be increased at weekly intervals based on clinical and hemodynamic response (See PRECAUTIONS and ADVERSE REACTIONS).

PART II: PHARMACEUTICAL INFORMATION

Drug Substance

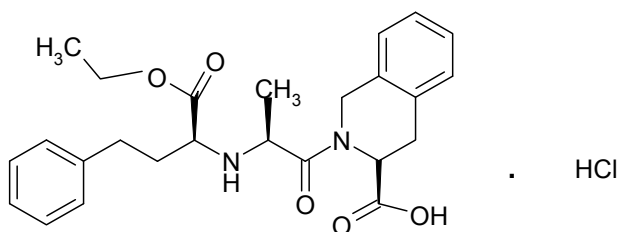
Proper Name: Quinapril Hydrochloride

Chemical Name: [3S-[2[R*(R*)],3R*]] 2-[2-[[1-(ethoxycarbonyl)-3-phenylpropyl]amino]-1-oxopropyl]-1,2,3,4-tetrahydro-3-isoquinolinecarboxylic acid monohydrochloride

Molecular Formula: C₂₅H₃₀N₂O₅.HCl

Molecular Weight: 474.98 g/mol

Molecular Structure:



Description: Quinapril hydrochloride is a white to off-white amorphous powder that is freely soluble in aqueous solvents. The pH of a 1% solution in distilled water is 2.5.

Solubility:	Solvent	% w/v solubility at RT
	Water	>10
	0.1N HCl	>10
	Methanol	>5
	95% Ethanol	>5
	Acetone	>5
	Chloroform	>5
	PEG 400	>10
	Propylene Glycol	>10

Dissociation Constants: pK_{a1} = 2.8
pK_{a2} = 5.4

Partition Coefficients:	Medium	Log-P
	0.1N HCl	0.86
	0.05M phosphate buffer, pH 2.5	0.68
	0.05M phosphate buffer, pH 4.0	1.35
	0.05M phosphate buffer, pH 7.4	0.33

Melting Range: Melts with decomposition, 108-115°C

Composition

QUINAPRIL tablets contain 5 mg, 10 mg, 20 mg or 40 mg quinapril per tablet (as quinapril hydrochloride). Each tablet also contains crospovidone, gelatin powder, iron oxide red, iron oxide yellow, lactose, polyethylene glycol, magnesium carbonate, magnesium stearate, polyvinyl alcohol, titanium dioxide.

Stability and Storage Recommendations

Store between 15°C and 30°C. Protect from moisture. Dispense in well-closed containers. Do not remove desiccant canisters from the container after bottle opening.

AVAILABILITY

QUINAPRIL (quinapril hydrochloride) tablets are supplied as follows:

- 5 mg:** Contains 5 mg quinapril per tablet. Brown, elliptical, scored, coated tablet debossed with "QP" and "5" on either side of the score on one side and "P" on the other side. Bottles of 100 and 500 tablets.
- 10 mg:** Contains 10 mg quinapril per tablet. Brown, triangular, coated tablet debossed with "QP" on one side and "10" on the other side. Bottles of 100 and 500 tablets.
- 20 mg:** Contains 20 mg quinapril per tablet. Brown, round, coated tablet debossed with "QP" on one side and "20" on the other side. Bottles of 100 and 500 tablets.
- 40 mg:** Contains 40 mg quinapril per tablet. Brown, elliptical, coated tablet debossed with "QP" on one side and "40" on the other side. Bottles of 100 and 500 tablets.

PHARMACOLOGY

Mechanism of Action

In Vitro Studies: Quinapril was shown to be an inhibitor of angiotensin converting enzyme (ACE) in both plasma and tissue. In assays utilizing human plasma as sources of ACE, the diacid form of quinapril (quinaprilat) exhibited greater inhibition of ACE activity than quinapril (6.4×10^{-10} M and 8.4×10^{-8} M respectively). In rabbit and rat aortic strips, quinapril (10^{-7} M, 10^{-5} M) specifically suppressed the contractile responses elicited by angiotensin I (50% contraction at approximately 10^{-7} M and 10^{-6} M angiotensin I respectively), but had no effect on contractions induced by angiotensin II and potassium chloride.

In Vivo Studies: Following oral dosing of quinapril, captopril or enalapril (0.1 to 3 mg/kg) to conscious normotensive rats, plasma ACE inhibition was assessed in vivo by the decrease in pressor response to intravenous angiotensin I, angiotensin II, norepinephrine and bradykinin. Quinapril produced a dose-dependent reduction (44% at 0.1 mg/kg, 81% at 0.3 mg/kg) of angiotensin I (0.32 µg/kg IV) pressor response and potentiated the response to bradykinin (154% after 0.3 mg/kg quinapril), but had no effect on angiotensin II and norepinephrine responses. Quinapril was equipotent to captopril and enalapril, but had a longer duration of action than captopril. In the conscious dog, oral administration of quinapril (0.1 to 3 mg/kg) resulted in plasma ACE inhibition comparable to that of enalapril and captopril.

In human subjects, quinapril at single oral doses of 10 to 20 mg/day produced 95 to 100% inhibition of plasma ACE activity at 0.5 hour postdose, with greater than 80% inhibition persisting at 24 hours postdose. Multiple oral doses of quinapril to humans for 12-weeks (20 to 80 mg/day) confirmed the inhibitory effect on plasma ACE and showed that it produces corresponding decreases in angiotensin II with significant increases in plasma renin activity. Once or twice daily dosing did not alter the results.

TOXICOLOGY

Acute Toxicity

The acute oral and intravenous toxicity of quinapril are summarized in Table 1.

Table 1: Acute Toxicity of Quinapril

Species	Sex	Route of Administration	Median Lethal Dose(mg/kg)
Mouse	Male	PO	1492-2150
	Female	PO	1440-2005
	Male	IV	504
	Female	IV	523
Rat	Male	PO	4280
	Female	PO	3541
	Male	IV	158-300
	Female	IV	108-273
Dog	Male & Female	PO	> 400

Quinapril showed a low order of acute toxicity. Clinical signs of toxicity in both mice and rats were depression or hypoactivity, prostration and ataxia. Peak mortality occurred within 24 hours in oral studies and within 15 minutes in intravenous studies. Asymptomatic oral dose levels were 500 mg/kg in mice and 1000 mg/kg in rats.

In the dog study, escalating oral doses of 50 to 400 mg/kg were given over 13-consecutive days. Vomiting occurred after doses of 150 mg/kg and above. Blood pressures decreased with increasing dose. At 400 mg/kg, the female had elevated creatinine and blood urea nitrogen (BUN) levels, decreased sodium and chloride levels, and granular casts in the urine. Gastric erosions and ulcers were seen in both animals and renal tubular dilatation was noted in the female.

The results of quinapril toxicity from subacute, chronic, reproductive, genetic, and carcinogenicity studies are given in Tables 2 to 6, respectively. Table 7 summarizes the results of toxicity studies with quinaprilat, the major active metabolite of quinapril.

Table 2: Subacute Toxicity Studies of Quinapril

Species	Duration (Week)	No. of Animals/ Sex/Group	Route	Doses (mg/kg/day)	Results
Mouse	2	10	PO	VC ¹ , 125,250, 500, 750.	One drug-related death at 750 mg/kg; reduced food consumption and body weight gain. MTD ² about 500 mg/kg.
Mouse	13	10	PO	VC, 50, 125, 250, 500	Body weight gain suppression, decreases in heart weight, hyperplasia of juxtaglomerular apparatus (JGA), MTD between 50 and 125 mg/kg.
Rat	2	5	PO	VC, 200, 400, 800, 1200	Deaths at 400, 800, and 1200 mg/kg; salivation, reduced food consumption, body weight gain suppression, pulmonary, renal, and gastric lesions.
Rat	2	10	PO	UC ¹ , VC, 100, 400, 800	Deaths at 400 and 800 mg/kg; respiratory signs, salivation, increased BUN, decreased RBC, Hgb, and Hct; increased liver weights, decreased heart weights; pulmonary edema and focal gastric erosions. MTD was between 400 and 800 mg/kg.
Rat	13	12	PO	UC, VC, 50, 250, 500	Deaths at 250 and 500 mg/kg; salivation; slightly increased BUN, CPK, and LDH; decreased RBC, Hct, and Hgb; decreased heart weight, pulmonary and gastric lesions at 250 mg/kg and higher; increased renin granules in JG cells. MTD between 50 and 250 mg/kg.
Dog	2	2	PO	VC, 25, 125,	No deaths; emesis, mild focal erosions and inflammation of the stomach at 125 mg/kg. MTD estimated as 250 mg/kg.
Dog	13	3	PO	250 (125 b.i.d.) VC, 25, 125, 250 (125 b.i.d.)	Sporadic emesis and anorexia; mild to moderate reversible increase in BUN and mild depression of RBC, Hct, Hgb at 250 mg/kg; focal gastric erosions at 125 mg/kg and above, increases in renin granules in JG cells; hypertrophy and hyperplasia of JGA. MTD was between 25 and 125 mg/kg.

¹VC = Vehicle Control; UC = Untreated Control.

²MTD = Maximum Tolerated Dose; RBC = red blood cell count; Hgb = hemoglobin; Hct = hematocrit; CPR = creatine phosphokinase; LDH = lactate dehydrogenase; JG = juxtaglomerular apparatus; BUN = blood urea nitrogen.

Table 3: Chronic Toxicity Studies of Quinapril

Species	Duration (Week)	No. of Animals / Sex / Group	Route	Doses (mg/kg/day)	Results
Rat	57 ¹	30	PO	UC ² , VC ² , 10, 50, 100	No drug-related deaths; transient post-dose salivation, body weight gain suppression, increased BUN, decreased glucose, increased plasma renin level, decreased heart weight, JGA hypertrophy and hyperplasia with increased granules; degenerative changes in kidneys.
Dog	52	4	PO	VC, 10, 50, 100	No deaths; elevation of plasma renin and liver enzyme levels, focal areas of chronic active inflammation in the liver at 100 mg/kg; gastric erosion at 50 mg/kg, and hypertrophy / hyperplasia of renal JGA.

¹52 weeks treatment plus 4 weeks without treatment for some animals

²UC = Untreated Control; VC = Vehicle Control; BUN = blood urea nitrogen; JGA = juxtaglomerular apparatus.

Table 4: Reproductive Toxicology Studies of Quinapril

Species	No. of Animals/ Sex/Group	Route	Doses (mg/kg/day)	Duration of Dosing	Results
<u>Fertility:</u>					
Rat	12 Male 24 Female	PO	VC ¹ , 10, 50, 100	<u>Males</u> -60 days prior to mating <u>Females</u> -14 days prior to mating until weaning of offspring	No effects on fertility, no adverse effects on F ₁ offspring parameters, and no teratogenic effects.
<u>Teratology:</u>					
Rat	5 Female	PO	100, 200, 400, 600, 800	Days 6 to 15 of gestation	No teratogenicity. Maternal deaths at 600 and 800 mg/kg; decreased fetal body weights at 200 mg/kg and higher.
Rat	20 Female	PO	UC ¹ , VC, 50, 150, 300	Days 6 to 15 of gestation	No fetotoxic or teratogenic effects. Reversible maternal toxicity.
Rabbit	5-7 Female	PO	10, 15, 25, 50, 100, 200,400	Days 6 to 18 of gestation	Severe materno- and fetotoxicity.
Rabbit	5 Female	PO	VC, 1, 2, 4, 6, 8	Days 6 to 18 of gestation	Abortions and maternal deaths at 4, 6, and 8 mg/kg; materno- and fetotoxicity at doses higher than 1 mg/kg.
Rabbit	14 Female	PO	VC, 0.5, 1.0, 1.5	Days 6 to 18 of gestation	Not teratogenic. Maternal weight loss; increased incidence of postimplantation loss (embryotoxicity) at 1.0 and 1.5 mg/kg.
<u>Perinatal/ Postnatal:</u>					
Rat	20 Female	PO	VC, 25, 75, 150	Day 15 of gestation to Day 20 of lactation	Reduction in offspring body weights from birth to Day 21 postnatally at 25, 75, and 150 mg/kg.

¹UC = Untreated Control; VC = Vehicle Control

Table 5: Genetic Toxicology Studies of Quinapril

Test		Dosage Range	Results
Mutagenicity			
1) In Vitro	a) Initial cytotoxicity in <i>Salmonella</i> strain	Up to 10,000 µg/plate	Non-cytotoxic.
2) In Vitro	b) Mutagenesis assay in <i>Salmonella</i>	625 to 10,000 µg /plate	Negative-with or without metabolic activation.
	a) Initial cytotoxicity assay	Up to 44,300 µg /mL	Cytotoxic at 1400 µg /mL and higher.
	b) Point mutation assay in Chinese hamster lung cells	175 to 1400 µg /mL	Negative - did not manifest direct acting or promutagen activity.
Cytogenetics			
1) In Vitro	a) Initial cytotoxicity assay	Up to 44,300 µg/mL	Cytotoxic at concentrations above 700 µg/mL.
	b) Sister chromatid exchange (SCE) assay in Chinese hamster ovary cells	10.94 to 1400 µg /mL	No increase in SCE at toxicity-limited doses up to 700 µg /mL in the presence of metabolic activation or up to 1400 µg /mL in the absence of metabolic activation.
2) In Vitro	a) Initial cytotoxicity assay	Up to 2700 µg/mL	Cytotoxic at 1200 µg /mL and higher.
	b) Structural chromosomal aberration (SCA) assay in Chinese hamster lung cells	800 to 1800 µg /mL	Slight, statistically significant increase in SCA with metabolic activation; not considered biologically significant.
3) In Vivo	a) Mouse micronucleus assay	1 to 1430 µg /kg	Not clastogenic; no increased frequency of micronuclei.

Table 6: Carcinogenicity Studies of Quinapril

Species	Duration	No. of Animals/	Route	Doses	Results
	(Week)	Sex/Group		(mg/kg/day)	
Mouse	104	50	PO	UC ¹ , VC ¹ 5, 35, 75	No evidence of tumorigenic potential. Reduced heart weight, nephritis, and JGA hypertrophy/hyperplasia.
Rat	104	65	PO	UC, VC, 10, 50, 100	No evidence of tumorigenic potential. Reduced RBC, JGA hypertrophy/hyperplasia and renal degenerative changes.

¹UC = Untreated Control; VC = Vehicle Control; JGA = juxtaglomerular apparatus; RBC = red blood cell count.

Table 7: Toxicity Studies of Quinaprilat

Species	Duration (Week)	No. of Animals/Sex/Group	Route	Doses (mg/kg/day)	Results
A. Acute Studies:					
Mouse	Single-dose	10	IV	VC ¹ , 250, 500, 1000	No deaths; MLD greater than 1000 mg/kg. No clinical or gross pathological changes
Rat	Single-dose	10	IV	VC, 50, 100, 200, 300, 400	No deaths; MLD greater than 400 mg/kg. No clinical or gross pathological changes
Dog	Escalating doses	1	IV	Escalating; 1-240	No deaths; MLD greater than 240 mg/kg. Reduced food consumption, weight loss, and slight increase in myeloid to erythroid ratio.
B. Subacute Studies:					
Rat	2	5	IV	VC, 25, 50, 100, 200	No deaths, clinical signs or adverse pathological findings.
Rat	4	10	IV	VC, 20, 100, 200	No drug-related deaths or clinical signs; reduced heart weights.
Dog	2	1	IV	VC, 10, 50, 100	Sporadic increases in heart rate.
Dog	4	3	IV	VC, 10, 50, 100	No clinical or gross pathologic findings; JGA hypertrophy/hyperplasia.
¹ VC = Vehicle Control; MLD = median lethal dose; JGA = juxtaglomerular apparatus					
C. Genotoxicity Studies:					
	Test		Dosage Range	Results	
Mutagenicity:					
In Vitro	a) Initial cytotoxicity in <i>Salmonella</i>		Up to 1200 µg/plate	Non-cytotoxic	
	b) Mutagenesis assay in <i>Salmonella</i>		75 to 1200 µg/plate	Negative-with or without metabolic activation	

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PART III: CONSUMER INFORMATION

PrQUINAPRIL
Quinapril Tablets, USP

This leaflet is part III of a three-part "Product Monograph" published when QUINAPRIL was approved for sale in Canada and is designed specifically for Consumers. This leaflet is a summary and will not tell you everything about QUINAPRIL. Contact your doctor or pharmacist if you have any questions about the drug.

ABOUT THIS MEDICATION

What the medication is used for:

High Blood Pressure (Hypertension)

QUINAPRIL lowers high blood pressure. It can be used alone or together with a diuretic ("water pill").

Congestive Heart Failure

QUINAPRIL is used for congestive heart failure (a condition where the heart is unable to pump enough blood for the body's needs), when it is combined with either a diuretic ("water pill") and/or digitalis glycosides (drugs which help the heart beat more normally).

What it does:

QUINAPRIL is an angiotensin converting enzyme (ACE) inhibitor. You can recognize ACE inhibitors because their medicinal ingredient ends in '-PRIL'.

This medicine does not cure your disease. It helps to control it. Therefore, it is important to continue taking QUINAPRIL regularly even if you feel fine.

When it should not be used:

Do not take QUINAPRIL if you:

- Are allergic to quinapril hydrochloride or to any nonmedicinal ingredient in the formulation.
- Have experienced an allergic reaction (angioedema) with swelling of the hands, feet, or ankles, face, lips, tongue, throat, or sudden difficulty breathing or swallowing, to any ACE inhibitor or without a known cause. Be sure to tell your doctor, nurse, or pharmacist that this has happened to you.
- Have been diagnosed with hereditary angioedema: an increased risk of getting an allergic reaction that is passed down through families. This can be triggered by different factors, such as surgery, flu, or dental procedures.
- Are pregnant or intend to become pregnant. Taking QUINAPRIL during pregnancy can cause injury and even death to your baby.
- Are breastfeeding. QUINAPRIL passes into breast milk.

- Have type 1 or type 2 diabetes or kidney problems and are taking medicine containing aliskiren
- Have renovascular hypertension (a form of high blood pressure that affects the blood vessels leading to the kidney's).
- Have one of the following rare hereditary diseases:
 - Galactose intolerance
 - Lapp lactase deficiency
 - Glucose-galactose malabsorption
 Because lactose is a non-medicinal ingredient in QUINAPRIL.

What the medicinal ingredient is:

Quinapril hydrochloride

What the nonmedicinal ingredients are:

crospovidone, gelatin powder, iron oxide red, iron oxide yellow, lactose, polyethylene glycol, magnesium carbonate, magnesium stearate, polyvinyl alcohol, titanium dioxide.

What dosage forms it comes in:

Tablets: 5 mg, 10 mg, 20 mg and 40 mg

WARNINGS AND PRECAUTIONS

Serious Warnings and Precautions - Pregnancy

QUINAPRIL should not be used during pregnancy. If you discover that you are pregnant while taking QUINAPRIL, stop the medication and contact your doctor, nurse, or pharmacist as soon as possible.

BEFORE you use QUINAPRIL talk to your doctor, nurse, or pharmacist if you:

- Are allergic to any drug used to lower blood pressure.
- Have recently received or are planning to get allergy shots for bee or wasp stings.
- Have narrowing of an artery or a heart valve.
- Have had a heart attack or stroke.
- Have heart failure.
- Have diabetes, liver or kidney disease.
- Are on dialysis or receiving LDL apheresis (treatment to remove "bad cholesterol" from the blood).
- Are dehydrated or suffer from excessive vomiting, diarrhea, or sweating.
- Are taking a salt substitute that contains potassium, potassium supplements, or a potassium-sparing diuretic (a specific kind of "water pill").
- Are on a low-salt diet.
- Are receiving gold (sodium aurothiomalate) injections.
- Are less than 18 years old.
- Are taking Aliskiren-containing medicines. Use of QUINAPRIL with these medicines is not recommended
- Are taking anti-cancer (temsirolimus, everolimus), anti-rejection (sirolimus) or anti-diabetic (gliptins) drugs. Use of

ACE inhibitors, such as QUINAPRIL, with these drugs may increase the chance of having an allergic reaction.

You may become sensitive to the sun while taking QUINAPRIL. Exposure to sunlight should be minimized until you know how you respond.

If you are going to have surgery and will be given an anesthetic, be sure to tell your doctor or dentist that you are taking QUINAPRIL.

Driving and using machines: Before you perform tasks which may require special attention, wait until you know how you respond to QUINAPRIL. Dizziness, lightheadedness, or fainting can especially occur after the first dose and when the dose is increased.

INTERACTIONS WITH THIS MEDICATION

As with most medicines, interactions with other drugs are possible. Tell your doctor, nurse, or pharmacist about all the medicines you take, including drugs prescribed by other doctors, vitamins, minerals, natural supplements, or alternative medicines.

The following may interact with QUINAPRIL:

Agents increasing serum potassium, such as a salt substitute that contains potassium, potassium supplements, or a potassium-sparing diuretic (a specific kind of “water pill”) or aliskiren. Use of QUINAPRIL with these medicines is not recommended.

- Alcohol
- Allopurinol used to treat gout.
- Anti-cancer drugs (e.g. temsirolimus and everolimus)
- Anti-rejection drugs, such as sirolimus
- Antidiabetic drugs, including insulin and oral medicines.
- Lithium used to treat bipolar disease.
- Nonsteroidal anti-inflammatory drugs (NSAIDs), used to reduce pain and swelling. Examples include ibuprofen, naproxen, and celecoxib.
- Other blood pressure lowering drugs, including diuretics (“water pills”). When taken in combination with QUINAPRIL, they may cause excessively low blood pressure.
- Tetracycline (a type of antibiotic)

PROPER USE OF THIS MEDICATION

Take QUINAPRIL exactly as prescribed. It is recommended to take your dose at about the same time every day.

Usual Adult Dose:

High Blood Pressure (Hypertension)

For patients not taking a diuretic (“water pills”): The recommended starting dose is 10 mg once a day.

For patients also taking a diuretic (“water pill”): The recommended starting dose is 5 mg once a day.

Congestive Heart Failure

The recommended starting dose is 5 mg once a day.

Overdose:

If you think you have taken too much QUINAPRIL contact your doctor, nurse, pharmacist, hospital emergency department or regional Poison control Centre immediately, even if there are no symptoms.

Missed Dose:

If you have forgotten to take your dose during the day, carry on with the next one at the usual time. Do not double dose.

SIDE EFFECTS AND WHAT TO DO ABOUT THEM

Side effects may include:

- dizziness
- drowsiness, fatigue, weakness
- cough
- rash, itching
- headache
- abdominal pain
- nausea, vomiting, diarrhea
- indigestion
- stuffy, runny nose
- back pain
- trouble sleeping

If any of these affects you severely, tell your doctor, nurse or pharmacist.

QUINAPRIL can cause abnormal blood test results. Your doctor will decide when to perform blood tests and will interpret the results.

SERIOUS SIDE EFFECTS, HOW OFTEN THEY HAPPEN AND WHAT TO DO ABOUT THEM

Symptom / effect	Talk with your doctor or pharmacist		Stop taking drug and seek immediate emergency medical attention
	Only if severe	In all cases	
Common	Low blood pressure: dizziness, fainting, lightheadedness. May occur when you go from lying or sitting to standing up.	✓	
	Increased levels of potassium in the blood: Irregular heartbeat, muscle weakness and generally feeling unwell		✓
Uncommon	Allergic reaction: rash, hives, swelling of the face, lips, tongue or throat, difficulty swallowing or breathing		✓
	Kidney disorder: change in frequency of urination, nausea, vomiting, swelling of extremities, fatigue		✓
	Liver disorder: yellowing of the skin or eyes, dark urine, abdominal pain, nausea, vomiting, loss of appetite		✓
	Electrolyte imbalance: weakness, drowsiness, muscle pain or cramps, irregular heartbeat		✓
	Tachycardia: Fast heart beat		✓
	Edema: Swelling of hands, ankles or feet		✓
	Decreased platelets: bruising, bleeding, fatigue and weakness		✓
Rare	Decreased white blood cells: infections, fatigue, fever, aches, pains, and flu-like symptoms		✓
	Chest Pain		✓
	Shortness of breath	✓	
	Coughing up blood		✓

This is not a complete list of side effects. For any unexpected effects while taking QUINAPRIL, contact your doctor or pharmacist.

HOW TO STORE IT

Store QUINAPRIL at room temperature, between 15°C and 30°C. Protect from moisture. Keep in well closed container.

Keep QUINAPRIL out of the reach and sight of children.

REPORTING SUSPECTED SIDE EFFECTS

You can report any suspected adverse reactions associated with the use of health products to the Canada Vigilance Program by one of the following 3 ways:

- Report online at www.healthcanada.gc.ca/medeffect
- Call toll-free at 1-866-234-2345
- Complete a Canada Vigilance Reporting Form and:
 - Fax toll-free to 1-866-678-6789, or
 - Mail to: Canada Vigilance Program
Health Canada
Postal Locator 0701E
Ottawa, Ontario
K1A 0K9

Postage paid labels, Canada Vigilance Reporting Form and the adverse reaction reporting guidelines are available on the MedEffect™ Canada Web site at www.healthcanada.gc.ca/medeffect.

NOTE: Should you require information related to the management of side effects, contact your health professional. The Canada Vigilance Program does not provide medical advice.

MORE INFORMATION

This document plus the full product monograph, prepared for health professionals, can be obtained by contacting Pro Doc Ltée at 1-800-361-8559, www.prodqc.ca or info@prodqc.ca.

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