ramipril (ra-mi-pril)

Uses

Classification
Therapeutic: antihypertensives
Pharmacologic: ACE inhibitors

Pregnancy Category D

Indications
Along with other agents in the management of hypertension. Reduction of risk of myocardial infarction, stroke, or death from cardiovascular causes in patients at least 55 years of age who are at high risk of developing a major cardiovascular event because of a history of coronary artery disease, stroke, peripheral vascular disease, or diabetes that is accompanied by at least one other cardiovascular risk factor. Reduction of risk of death, heart failure–related hospitalizations, and progression of heart failure in patients with signs of heart failure following myocardial infarction.

Action
Angiotensin-converting enzyme (ACE) inhibitors block the conversion of angiotensin I to the vasoconstrictor angiotensin II. ACE inhibitors also prevent the degradation of bradykinin and other vasodilatory prostaglandins. ACE inhibitors also raise plasma renin levels and lower aldosterone levels. Net result is systemic vasodilation.

Therapeutic Effects:
Lowering of BP in hypertensive patients. Decreased risk of myocardial infarction, stroke, or death from cardiovascular causes in high-risk patients. Increased survival and decreased heart failure progression after myocardial infarction.

Pharmacokinetics
Absorption: 50–60% absorbed following oral administration.

Distribution: Crosses the placenta; may enter breast milk.

Metabolism and Excretion: Converted by the liver to ramiprilat, the active metabolite; 60% excreted in urine; 40% in feces.

Half-life: Ramiprilat: 13–17 hr (q in renal impairment).

TIME/ACTION PROFILE (effect on BP—single dose†)

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<tr>
<th>ROUTE</th>
<th>ONSET</th>
<th>PEAK</th>
<th>DURATION</th>
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<td>PO</td>
<td>within 1–2 hr</td>
<td>3–6 hr</td>
<td>24 hr</td>
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†Full effects may not be noted for several wk.

Contraindications/Precautions
Contraindicated in: Hypersensitivity; History of angioedema with previous use of ACE inhibitors; Concurrent use with aliskiren in patients with diabetes or moderate-to-severe renal impairment (CrCl < 60 mL/min); OB: Can cause injury or death of fetus—if pregnancy occurs, discontinue immediately; Lactation: Discontinue drug or use formula.

Use Cautiously in: Black patients (monotherapy for hypertension less effective, may require additional therapy; higher risk of angioedema); Surgery/anesthesia (hypotension may be exaggerated); Women of childbearing potential (renal impairment especially renal artery stenosis, hypertension, concurrent diuretic therapy—initial dose j recommended); Pedi: Safety not established; Geri: Initial dose j recommended.

Exercise Extreme Caution in: Family history of angioedema.

Adverse Reactions/Side Effects
CNS: dizziness, fatigue, headache, vertigo, weakness.
Resp: cough.
CV: hypotension, chest pain.
GI: diarrhea, nausea, vomiting.
GU: impaired renal function.
Derm: rashes.
F and E: hyperkalemia.
Misc: ANGIOEDEMA.

Interactions
Drug-Drug: Excessive hypotension may occur with concurrent use of diuretics, additive hypertension with other antihypertensive agents. Risk of hyperkalemia with concurrent use of potassium supplements, potassium-sparing diuretics, or potassium-containing salt substitutes. Risk of hyperkalemia, renal dysfunction, hypertension, and edema with concurrent use of angiotensin II receptor antagonists or aliskiren; avoid concurrent use with aliskiren in patients with diabetes or CrCl < 60 mL/min. NSAIDs and selective COX-2 inhibitors may blunt the anti-hypertensive effect and the risk of renal dysfunction. Levels and fate of lithium toxicity. Risk of renal dysfunction when used with telmisartan; concurrent use not recommended. Risk of angioedema with tenofovir or etravirine.

Route/Dosage
Hypertension
PO (Adults): 2.5 mg once daily, slowly may be up to 20 mg/day in 1–2 divided doses (initiate therapy at 1.25 mg/day in patients receiving diuretics).

Heart Failure Post-Myocardial Infarction
PO (Adults): 1.25–2.5 mg twice daily initially, may be up to 5 mg twice daily.

Concomitant Drug therapy:

ACE inhibitors + ARBs + NSAIDs + diuretics = increased risk of hypotension, potassium accumulation, and renal dysfunction. Angiotensin II antagonists + ARBs + NSAIDs = increased risk of hypotension, renal dysfunction, and hyperkalemia. ACE inhibitors + ARBs + diuretics = increased risk of hypotension, potassium accumulation, and renal dysfunction.
Reduction in Risk of MI, Stroke, and Death from Cardiovascular Causes

**PO (Adults):** 2.5 mg once daily for 1 wk, then 5 mg once daily for 1 wk, then 10 mg once daily (can also be given in 2 divided doses).

Renal Impairment

**PO (Adults):** CCr ≤ 40 mL/min—Initiate therapy at 1.25 mg once daily, may be slowly titrated up to 5 mg/day in 1–2 divided doses.

**NURSING IMPLICATIONS**

**Assessment**

- **Hypertension:** Monitor BP and pulse frequently during initial dose adjustment and periodically during therapy. Notify health care professional of significant changes.
- **Monitor frequency of prescription refills to determine compliance.
- **Assess patient for signs of angioedema (dyspnea, facial swelling).
- **Heart Failure:** Monitor weight and assess patient routinely for resolution of fluid overload (peripheral edema, rales/crackles, dyspnea, weight gain, jugular venous distention).

**Lab Test Considerations:** Monitor renal function. May cause ↑ BUN and serum creatinine.

- **May cause hyperkalemia.
- **May cause neutropenia and eosinophilia.
- **May cause ↑ AST, ALT, alkaline phosphatase, serum bilirubin, uric acid, and glucose.

Potential Nursing Diagnoses

- Decreased cardiac output (Indications) (Side Effects)
- Deficient knowledge, related to medication regimen (Patient/Family Teaching)
- Noncompliance (Patient/Family Teaching)

**Implementation**

- Correct volume depletion, if possible, before initiation of therapy. Precipitous drop in BP during first 1–3 hr following first dose may require volume expansion with normal saline. Discontinue diuretic therapy or cautiously increasing salt intake 2–3 days prior to initiation may decrease risk. Monitor closely for at least 1 hr after 1st dose has stabilized. Resume diuretics if BP is not controlled.
- **PO:** Capsules may be opened and sprinkled on applesauce, or dissolved in 4 oz water or apple juice for patients with difficulty swallowing. Effervescent 10 mg capsules are unavailable. Pre-prepared mixtures can be stored up to 24 hr at room temperature or up to 48 hr if refrigerated.

**Patient/Family Teaching**

- Emphasize the importance of continuing to take medication as directed at the same time each day, even if feeling well. Take missed doses as soon as remembered but no almost time for next dose. Do not double doses. Warn patient not to discontinue ACE inhibitor therapy unless directed by health care professional.
- Caution patient to avoid salt substitutes containing potassium or foods containing high levels of potassium or sodium unless directed by health care professional.
- Caution patient to change positions slowly to minimize orthostatic hypotension. Use of alcohol, standing for long periods, exercising, and hot weather may increase orthostatic hypotension.
- Instruct patient to notify health care professional of all Rx or OTC medications, vitamins, or herbal products being taken and consult health care professional before taking any new medications especially cough, cold, or allergy medications.
- Monitor weight and assess patient routinely for resolution of fluid overload (peripheral edema, rales/crackles, dyspnea, weight gain, jugular venous distention).

- **May cause tinnitus.** Caution patient to avoid driving and other activities requiring alertness until response to medication is known.
- Advise patient to inform health care professional of medication regimen prior to treatment or surgery.
- Instruct patient to notify health care professional if rash; mouth sores; sore throat; fever; swelling of hands or feet; irregular heartbeat; chest pain; dry cough; hoarseness; swelling of face, eyes, lips, or tongue; or if difficulty swallowing or breathing occurs. Persistent dry cough may occur and may not subside until medication is discontinued. Consult health care professional if cough becomes bothersome. Also notify health care professional if naso, oropharyngeal or laryngeal edema occurs and continues.
- Advise women of childbearing age to use contraception and notify health care professional if pregnancy is planned or suspected or if breast feeding. If pregnancy is detected, discontinue medication as soon as possible.

- Emphasize the importance of follow-up examinations to evaluate effectiveness of medication.

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ramipril

- Hypertension: Encourage patient to comply with additional interventions for hypertension (weight reduction, low-sodium diet, discontinuation of smoking, moderation of alcohol consumption, regular exercise, and stress management). Medication controls but does not cure hypertension.
- Instruct patient and family on correct technique for monitoring BP. Advise them to check BP at least weekly and to report significant changes to health care professional.

Evaluation/Desired Outcomes
- Decrease in BP without appearance of side effects.
- Reduction in risk of myocardial infarction, stroke, or death from cardiovascular causes in patients at high risk for these events.
- Reduction in risk of death, progression of heart failure, or heart failure-related hospitalizations following myocardial infarction.

Why was this drug prescribed for your patient?