Amlodipine or lisinopril was not better than chlorthalidone in lowering CHD risk in hypertension

**Major outcomes in high-risk hypertensive patients randomized to angiotensin-converting enzyme inhibitor or calcium channel blocker vs diuretic: The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT).** *JAMA* 2002;288:2981–97.

**QUESTION:** In predominately older patients with hypertension and ≥1 other coronary heart disease (CHD) risk factor, is amlodipine or lisinopril better than chlorthalidone in lowering the risk for CHD or other cardiovascular disease (CVD) events?

**Design**
Randomised (allocation concealed*), blinded (patients, clinicians, data collectors, outcome assessors, and steering committee†,* controlled trial with mean 4.9 years of follow up (Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial [ALLHAT]).

**Setting**
623 centres in the US, Canada, Puerto Rico, and the US Virgin Islands.

**Patients**
33 357 patients ≥55 years of age (mean age 67 years, 53% men) who had stage 1 or stage 2 hypertension and ≥1 additional risk factor for CHD. The risk factors were myocardial infarction (MI) or stroke in the previous 6 months, left ventricular hypertrophy, type 2 diabetes, smoking, high density lipoprotein cholesterol < 0.91 mmol/L, or other atherosclerotic CVD. Patients with a history of heart failure (HF) or known left ventricular ejection fraction < 35% were excluded. Follow up was 97%; all randomised patients were included in the analysis.

**Intervention**
Patients were allocated to chlorthalidone, 12.5–25 mg/day (n=15 255); amlodipine, 2.5–10 mg/day (n=9054); or lisinopril, 10–40 mg/day (n=9054).

**Main outcome measures**
Combined fatal CHD or nonfatal MI. Secondary outcomes were all cause mortality, fatal and nonfatal stroke, combined CHD (the primary outcome, coronary revascularisation [coronary artery bypass graft, percutaneous angioplasty, insertion of stents, and atherectomy], and hospital admission for angina), and combined CVD (combined CHD, stroke, other treated angina, HF [fatal, hospitalised, or treated non-hospitalised], and peripheral arterial disease).

**Main results**
Analysis was by intention to treat. Patients who received amlodipine or lisinopril did not differ from those who received chlorthalidone for the primary outcome (table). The amlodipine group had a 38% (95% CI 25 to 52) relative risk increase for HF and a 35% (CI 21 to 50) greater risk of hospitalised fatal HF than did the chlorthalidone group. The lisinopril group had a 15% (CI 2 to 30) greater risk of stroke and a 10% (CI 5 to 16) greater risk of combined CVD than did the chlorthalidone group.

**Conclusions**
In older patients with hypertension and ≥1 other coronary heart disease (CHD) risk factor, amlodipine or lisinopril was not better than chlorthalidone in lowering the risk of CHD or other cardiovascular disease (CVD) events. Risks of some CVD events were greater with amlodipine or lisinopril.

*See glossary.
†Information provided by author.

**Amiodipine or lisinopril v chlorthalidone for combined fatal CHD or non-fatal MI at mean 4.9 years.**

<table>
<thead>
<tr>
<th></th>
<th>Amlodipine</th>
<th>Lisinopril</th>
<th>Chlorthalidone</th>
<th>RRR (95% CI)</th>
<th>NNT</th>
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</thead>
<tbody>
<tr>
<td>11.3% (95% CI)</td>
<td>—</td>
<td>11.5%</td>
<td>2% (7–10)</td>
<td>Not significant</td>
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</tr>
<tr>
<td>11.4%</td>
<td>11.5%</td>
<td>1% (7–9)</td>
<td></td>
<td>Not significant</td>
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</table>

CHD = coronary heart disease; MI = myocardial infarction. Other abbreviations defined in glossary.

**COMMENTARY**
A study of astonishing methodological beauty, ALLHAT is a large, simple, practice based, double blind, active comparison trial that poses important public health questions about the effects of first line antihypertensive therapies on major health outcomes, including MI, stroke, and HF. This combination of excellent methods and outstanding questions means that the findings merit careful attention, wide dissemination, and clinical translation.

In ALLHAT, neither the calcium channel blocker amlodipine nor the ACE inhibitor lisinopril was better than the low dose diuretic chlorthalidone for any primary or secondary outcome. Conversely, low dose diuretics were superior to amlodipine or lisinopril for at least 1 major disease outcome. Low dose diuretics alone should be the first line drug therapy for hypertension.

For patients starting drug therapy, low dose diuretics should be the initial therapy for uncomplicated hypertension, although it may take 4 weeks to achieve maximum effect. If blood pressure (BP) is not controlled on diuretics alone, a second drug should be added. Many patients are already treated, but not with a diuretic. For those with uncontrolled BP on a non-diuretic regimen, a low dose diuretic should be added. If BP is controlled with a non-diuretic, the patient should be switched to a low-dose diuretic.

The ALLHAT trial, led by academic researchers and funded by the US National Institutes of Health and Pfizer, represents an important university industry collaboration: newer drugs on a non-diuretic regimen, a low dose diuretic should be added. If BP is controlled with a non-diuretic, the patient should be switched to a low-dose diuretic. For patients starting drug therapy, low dose diuretics should be the initial therapy for uncomplicated hypertension, although it may take 4 weeks to achieve maximum effect. If blood pressure (BP) is not controlled on diuretics alone, a second drug should be added. Many patients are already treated, but not with a diuretic. For those with uncontrolled BP on a non-diuretic regimen, a low dose diuretic should be added. If BP is controlled with a non-diuretic, the patient should be switched to a low-dose diuretic.

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