

What should the optimal blood pressure goal be in patients with diabetes mellitus or chronic kidney disease?

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In the absence of randomized control data, the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommended that patients with diabetes mellitus or with chronic kidney disease should have their blood pressure reduced to less than 130/80 mm Hg [1]. In the absence of randomized control data, the American Diabetes Association recommended that patients with diabetes mellitus and hypertension should have their blood pressure reduced to less than 130/80 mm Hg [2]. In the absence of randomized control data, the National Kidney Foundation Kidney Disease Outcome Quality Initiative guidelines recommended that patients with chronic kidney disease and hypertension should have their blood pressure reduced to less than 130/80 mm Hg [3]. In the absence of randomized control data, the American Heart Association 2007 guidelines recommended that patients with diabetes mellitus or with chronic kidney disease and hypertension should have their blood pressure reduced to less than 130/80 mm Hg [4].

The 2009 European Society of Hypertension guidelines stated that reducing the blood pressure to less than 130/80 mm Hg in patients with diabetes mellitus or chronic kidney disease and hypertension is unsupported by prospective trial data, and that the systolic blood pressure should be reduced to less than 140 mm Hg in these patients [5]. The American College of Cardiology Foundation/American Heart Association 2011 expert consensus document on hypertension in the elderly recommended that the blood pressure should be reduced to less than 140/90 mm Hg in adults younger than 80 years with diabetes mellitus or chronic kidney disease [6]. On the basis of data from the Hypertension in the Very Elderly trial [7], these guidelines recommended that the systolic blood pressure should be reduced to 140 mm Hg to 145 mm Hg if tolerated in adults aged 80 years and older [6]. I concur with these guidelines [5, 6, 8-13]. The following studies discuss the reasons for my recommendations.

The Pravastatin or Atorvastatin Evaluation and Infection Therapy-Thrombolysis in Myocardial Infarction (PROVE IT-TIMI) 22 trial enrolled 4,162 patients with an acute coronary syndrome (17% with diabetes mellitus and 9% with chronic kidney disease) [14]. At 24-month follow-up, the lowest cardiovascular events rates occurred with a systolic blood pressure between 130 mm Hg to 140 mm Hg and a diastolic blood pressure between 80 mm Hg to 90 mm Hg with a nadir of 136/85 mm Hg [14].

An observational subgroup analysis was performed in 6,400 of the 22,576 persons enrolled in the International Verapamil SR-Trandolapril Study (INVEST) [15]. The study participants had diabetes mellitus and coronary artery disease. Persons were categorized as having tight control of their blood pressure if they could maintain their systolic blood pressure below 130 mm Hg and their diastolic blood pressure below 85 mm Hg, usual control if they could maintain their systolic blood pressure between 130 mm Hg to 139 mm Hg, and uncontrolled if their systolic blood pressure was 140 mm Hg or higher.

During 16,893 patient-years of follow-up, a cardiovascular event rate of 12.6% occurred in patients with usual control of blood pressure versus 19.8% in patients with uncontrolled hypertension, $p < 0.001$ [15]. The incidence of cardiovascular events was 12.6% in patients with usual control of blood pressure vs. 12.7% in patients with tight control of blood pressure (p not significant). The all-cause mortality rate was 11.0% with tight control of blood pressure vs. 10.2% with usual control of blood pressure ($p = 0.06$). When extended follow-up to 5 years following the close of INVEST was included, the all-cause mortality rate was 22.8% with tight control of blood pressure vs. 21.8% with usual control of blood pressure, $p = 0.04$ [15].

The Action to Control Cardiovascular Risk in Diabetes (ACCORD) blood pressure trial randomized 4,733 persons with type 2 diabetes mellitus to intensive blood pressure control with a target systolic blood pressure of < 120 mm Hg or to standard blood pressure control with a target systolic blood pressure < 140 mm Hg [16]. The primary composite outcome was nonfatal myocardial infarction, nonfatal stroke, or death from cardiovascular causes. Mean follow-up was 4.7 years. After 1 year, the mean systolic blood pressure was 119.3 mm Hg in the intensive blood pressure control group vs. 133.5 mm Hg in the standard blood pressure control group. The annual rate of the primary outcome was 1.87% in the intensive blood pressure control group vs. 2.09% in the standard blood pressure control group (p not significant) [16]. The annual rate of death from any cause was 1.28% in the intensive blood pressure control group vs. 1.19% in the standard blood pressure control group (p not significant). The annual rate of death from cardiovascular causes was 0.52% in the intensive blood pressure control group vs. 0.49% in the standard blood pressure control group (p not significant). The annual stroke rate, a prespecified secondary outcome, was 0.32% in the intensive blood pressure control group vs. 0.53% in the standard blood pressure control group, $p = 0.01$ (number needed to treat to reduce 1 stroke = 476 patients). Serious

adverse events attributed to antihypertensive treatment occurred in 3.3% of the intensive blood pressure control group vs. 1.3% of the standard blood pressure control group ($p < 0.001$) [16].

The ONgoing Telmisartan Alone and in combination with Ramipril Global Endpoint Trial (ONTARGET) included 9,603 diabetics, mean age 66.1 years, and 15,981 nondiabetics, mean age 66.6 years, with hypertension at high risk for cardiovascular events [17]. The primary outcome was a composite of cardiovascular death, nonfatal myocardial infarction, nonfatal stroke, or hospitalization for heart failure. Mean follow-up was 4.6 years. Compared with nondiabetics, diabetics had a 48% significant increase in the primary endpoint, a 56% significant increase in cardiovascular death, a 30% significant increase in myocardial infarction, a 39% significant increase in stroke, and a 206% significant increase in hospitalization for congestive heart failure [17].

In both diabetics and nondiabetics, antihypertensive drug treatment reduced the primary outcome if the baseline systolic blood pressure was between 143 mm Hg to 155 mm Hg [17]. Except for stroke, there was no benefit in reducing fatal or nonfatal cardiovascular outcomes by reducing the systolic blood pressure below 130 mm Hg in diabetics and in nondiabetics. The lowest incidence of death from cardiovascular causes in diabetics occurred with a systolic blood pressure of 135.6 mm Hg (range 130.6 mm Hg to 140.5 mm Hg). The lowest incidence of death from cardiovascular causes in nondiabetics occurred with a systolic blood pressure of 133.1 mm Hg (range 128.8 mm Hg to 137.4 mm Hg). For the primary outcome, the highest risk in both diabetics and in nondiabetics occurred in patients with the lowest or highest intrial diastolic blood pressure (67.2 mm Hg and 86.7 mm Hg, respectively) [17].

The mean systolic blood pressure was 144 mm Hg in both the intensively treated diabetics in the United Kingdom Prospective Diabetes Study [18] and in the post hoc subgroup analysis of the Hypertension Optimal Treatment trial [19]. The mean systolic blood pressure was 135 mm Hg in the intensively treated diabetics in the Action in Diabetes and Vascular Disease: Preterax and Diamicon Modified Release Controlled Evaluation (ADVANCE study) [20].

A meta-analysis was performed which included the 2,272 patients with hypertensive chronic kidney disease without diabetes mellitus in the African American Study of Kidney Disease and Hypertension (AASK) [21], the Modification of Diet in Renal Disease (MDRD) [22], and the Ramipril Efficacy in Nephropathy 2 (REIN-2) [23] trials [24]. This meta-analysis showed that a blood pressure of less than 125/75 mm Hg to 130/80 mm Hg did not improve clinical outcomes more than a tar-

get blood pressure of less than 140/90 mm Hg [24]. Whether a blood pressure of less than 130/80 mm Hg benefits patients with proteinuria greater than 300 to 1,000 mg per day requires further study [24].

Intensive lowering of blood pressure also does not improve clinical outcomes in patients with a recent noncardioembolic stroke [25] or with heart failure [26]. On the basis of the available data, the blood pressure in patients with hypertension at high risk for cardiovascular events because of coronary artery disease, diabetes mellitus, chronic kidney disease, stroke, or heart failure should be reduced to less than 140/90 mm Hg in patients younger than 80 years and the systolic blood pressure reduced to 140 to 145 mm Hg if tolerated in patients aged 80 years and older [6].

Acknowledgments

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