

Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38.

UK Prospective Diabetes Study Group.

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OBJECTIVE: To determine whether tight control of blood pressure prevents macrovascular and microvascular complications in patients with type 2 diabetes. **DESIGN:** Randomised controlled trial comparing tight control of blood pressure aiming at a blood pressure of <150/85 mm Hg (with the use of an angiotensin converting enzyme inhibitor captopril or a beta blocker atenolol as main treatment) with less tight control aiming at a blood pressure of <180/105 mm Hg. **SETTING:** 20 hospital based clinics in England, Scotland, and Northern Ireland. **SUBJECTS:** 1148 hypertensive patients with type 2 diabetes (mean age 56, mean blood pressure at entry 160/94 mm Hg); 758 patients were allocated to tight control of blood pressure and 390 patients to less tight control with a median follow up of 8.4 years. **MAIN OUTCOME MEASURES:** Predefined clinical end points, fatal and non-fatal, related to diabetes, deaths related to diabetes, and all cause mortality. Surrogate measures of microvascular disease included urinary albumin excretion and retinal photography. **RESULTS:** Mean blood pressure during follow up was significantly reduced in the group assigned tight blood pressure control (144/82 mm Hg) compared with the group assigned to less tight control (154/87 mm Hg) ($P < 0.0001$). Reductions in risk in the group assigned to tight control compared with that assigned to less tight control were 24% in diabetes related end points (95% confidence interval 8% to 38%) ($P = 0.0046$), 32% in deaths related to diabetes (6% to 51%) ($P = 0.019$), 44% in strokes (11% to 65%) ($P = 0.013$), and 37% in microvascular end points (11% to 56%) ($P = 0.0092$), predominantly owing to a reduced risk of retinal photocoagulation. There was a non-significant reduction in all cause mortality. After nine years of follow up the group assigned to tight blood pressure control also had a 34% reduction in risk in the proportion of patients with deterioration of retinopathy by two steps (99% confidence interval 11% to 50%) ($P = 0.0004$) and a 47% reduced risk (7% to 70%) ($P = 0.004$) of deterioration in visual acuity by three lines of the early treatment of diabetic retinopathy study (ETDRS) chart. After nine years of follow up 29% of patients in the group assigned to tight

control required three or more treatments to lower blood pressure to achieve target blood pressures. CONCLUSION: Tight blood pressure control in patients with hypertension and type 2 diabetes achieves a clinically important reduction in the risk of deaths related to diabetes, complications related to diabetes, progression of diabetic retinopathy, and deterioration in visual acuity.