Blood pressure levels, cardiovascular events and mortality in patients with type 2 diabetes and renal impairment – a national-wide observational register study.

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Background and aim

There has been an intensive debate on which blood pressure level that would be optimal to reduce cardiovascular disease (CVD) and mortality in patients with type 2 diabetes with renal impairment (RI). We therefore assessed the relationship between blood pressure level and risk of cardiovascular events (CVE) and all-cause mortality in patients with type 2 diabetes (T2D) and (RI) in clinical practice.

Patients and methods

•33 356 patients with T2D and RI with at least one serum creatinine and blood pressure (BP) value available in the Swedish National Diabetes Register between Juli 2005-Dec 2007 were followed until 31 Dec 2011 or until death (table 1).

•Renal impairment was defined as estimated glomerular filtration rate (eGFR) <60 ml/min/1.73 m^2 (MDRD). BP were the mean of all reported BPs during the follow-up period..

•. The relationships between mean BPs, CVEs and mortality were assessed by time-dependent Cox models, to estimate hazard ratios (HR), adjusting for CV risk factors and medications

Results

•The lowest risks of CVEs and all-cause mortality were observed with SBP 135-139 and DBP 72-74 mmHg, respectively (reference levels).

•The highest risks were found with SBP interval 80-120 and 160-230 mmHg (table 2a) and DBP interval 40-63 mmHg and DBP 83-125 mmHg (table 2b), respectively.

• Adjustments for presence of albuminuria did not markedly alter the results.

•During the follow-up period (median 5.3 years), 11,899 CVEs and 10,691 deaths occurred. The most common causes of death were CVEs (34%) and malignancies (15%).

Table 1. Clinical and biochemical characteristics of patients with T2D and RI (eGFR < 60 ml/min/1.73m²) (n=33 356).

Age (years)	75 ± 9
Male (%)	43
Smokers (%)	7
Diabetes duration (years)	10 ± 8
HbA1c (mmol/mol)	54± 13
SBP (mmHg)	141± 19
DBP (mmHg)	75 ± 10
BMI (kg/m²)	29 ± 5
LDL-cholesterol (mmol/L)	2.7 ± 0.9
HDL-cholesterol (mmol/L)	1.3 ± 0.4
Triglycerides (mmol/L)	2.0 ± 1.1
eGFR (ml/min/1.73m²)	48 ± 9
Any retinopathy (%)	23
History of CVD /CHF (%)	33/15
Lipid-lowering (%)	54
Antihypertensive (%)	88
Albuminuria /Micro//Macro(%)	30/16/14

Means±SD or frequencies (%) are given. SBP; systolic blood pressure, DBP; diastolic blood pressure, BMI; body mass index, eGFR; estimated glomerular filtration rate, CVEs; cardiovascular disease (a composite of coronary heart disease and/or stroke), CHF; congestive heart failure, Microalbuminuria; urinary albumin excretion rate 20–200 mg/min. Macroalbuminuria; albumin excretion rate > 200 mg/min. eGFR according to MDRD

Table 2a. Hazard ratios of CVD and all-cause mortality by all participants by decils of *systolic blood pressure*

SBP mmHg Interval	SBP Mean±SD	HR CVD 95% CI	HR Mortality 95% CI
80-120	114±7	2.30 (2.03-2.60)	2.40 (2.11-2.73)
120-127	124±2	1.37 (1.20-1.55)	1.40 (1.22-1.60)
128-131	130±1	1.64 (1.44-1.86)	1.53 (1.35-1.76)
131-135	134±1	1.36 (1.20-1.55)	1.22 (1.05-1.41)
135-139	137±1	1	1
139-142	140±1	1.78 (1.57-2.02)	1.61 (1.41-1.84)
142-146	144±1	1.39 (1.22-1.58)	1.23 (1.07-1.42)
146-151	149±2	1.77 (1.56-2.01)	1.30 (1.13-1.50)
151-160	155±3	1.46 (1.28-1.66)	1.27 (1.10-1.46)
160-230	169±10	2.95 (2.62-3.34)	2.02 (1.78-2.30)

Table 2b. Hazard ratios of CVD and all-cause mortality by all participants by decils of *diastolic blood pressure*

DBP mmHg Interval	DBP Mean±SD	HR CVD 95% CI	HR Mortality 95% CI
40-63	50±3	2.00 (1.80-2.22)	2.00 (1.78-2.24)
63-67	65±1	1.21 (1.07-1.37)	1.21 (1.07-1.37)
67-70	68±1	1.15 (1.01-1.30)	1.14 (1.03-1.30)
70-72	70±0.5	1.88 (1.67-2.11)	1.88 (1.67-2.11)
72-74	73±1	1	1
74-76	75±0.5	1.43 (1.26-1.62)	1.44 (1.28-1.63)
76-78	77±1	1.23 (1.07-1.41)	1.24 (1.01-1.41)
78-80	79±1	1.78 (1.58-2.01)	1.81 (1.60-2.04)
80-83	81±1	1.60 (1.40-1.80)	1.62 (1.42-1.82)
83-125	88±4	2.26 (2.00-2.54)	2.30 (2.03-2.59)

SBP; systolic blood pressure, blood pressures are means±sd; [a]Fatal and non-fatal coronary heart disease (CHD), [b]fatal and non-fatal cardiovascular disease (CVD), [c]Hazard ratios (HR) with 95% confidence interval adjusted for age, diabetes duration, gender, HbA1c, BMI, presence/absence of albuminuria , smoking, LDL-cholesterol, triglycerides/HDL, history of cardiovascular disease (CVD), previous history of congestive heart failure (CHF), antihypertensive and lipid lowering treatment. [d]systolic blood pressure 135-139 mm Hg was defined as the reference a group, see methods section.

Figure 1a+b. The 6-year CVD rate (%) in all participants with SBP (a) or DBP (b) as a continuous variable.

Fig. 1a

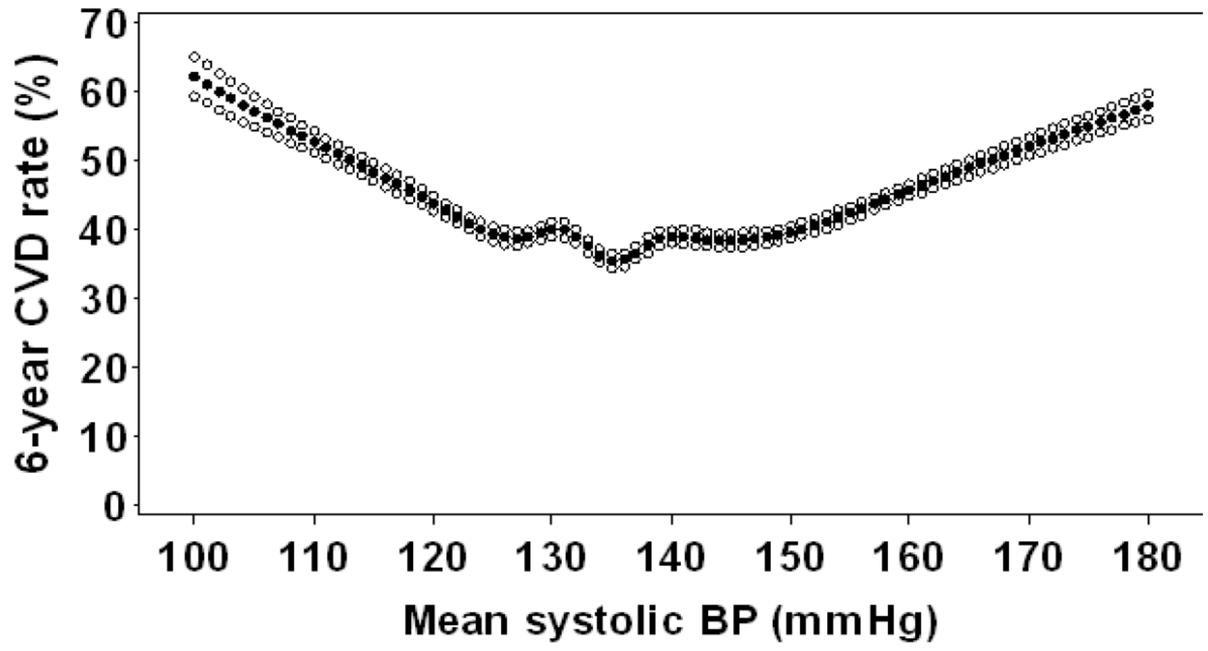
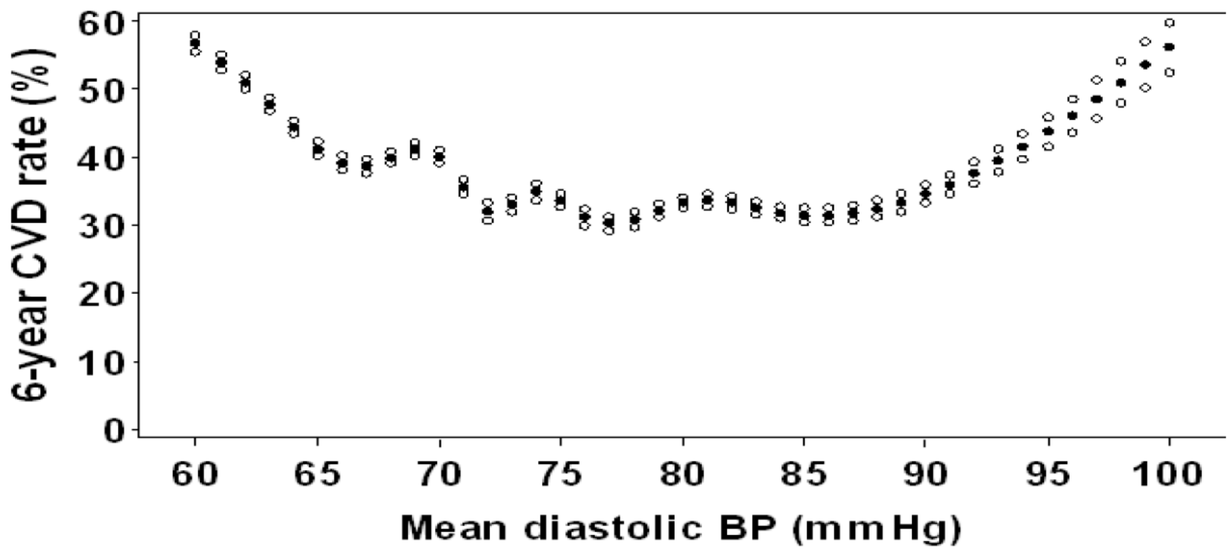


Fig. 1b



Splines with nine knots at deciles (filled circles) and 95% confidence intervals (unfilled circles) and square of SBP or DBP for analysis of nonlinear relationship in a Cox regression model, adjustment for covariates as in Table 2.

Conclusions

•The risk of CV events and all-cause mortality increased significantly with both high and low SBP and DBP.

•In patients with type 2 diabetes and renal impairment, systolic blood pressure 135-139 and diastolic blood pressure 72-74 mmHg were associated with the lowest risks of CV events and all-cause mortality

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I) Diabetes. I2) Clinical studies.

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