

Editorial

# The risk of coronary heart disease varies with blood pressure grades and glycemic metabolism statuses in a hypertensive

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## To the Editor

Coronary heart disease (CHD) is the leading cause of death worldwide [1]. In China, the prevalence of CHD has kept continually increasing, with the number of patients being approximately 11.39 million, at present [2] and CHD poses a substantial threat to human health. Hypertension and diabetes both are the major risk factors for CHD [2,3] and the risk of CHD in patients with coexisting hypertension and diabetes is higher than that in patients with either of the two diseases [4]. In China, 27.5% of adults aged  $\geq 18$  years have hypertension in 2018 [5] and about 24.3% of hypertensive patients also have diabetes [6]. Therefore, hypertensives should be aware of the prevention and treatment of diabetes to prevent the occurrence of CHD. Although studies have been conducted on the relationship of hypertension with diabetes and cardiovascular and cerebrovascular complications [4,7-10], the detailed relationship between CHD and different blood pressure grades and glycemic metabolism status in hypertensive patients is unclear.

This study is based on the sub-project "Cardiovascular Disease Monitoring, Prevention and Early Warning, and Diagnosis and Treatment Technology Application Research" of the health industry scientific research project "Cardiovascular Disease Risk Factor Monitoring and Standardized Management of Hypertension" [11], in which 38031 hypertensive patients were investigated from 220 community health service centers in 15 provinces. Blood pressure was measured by a trained doctor with a mercury sphygmomanometer when the subjects came to community health service centers. The average of three consecutive readings was used in the analysis. Hypertension was defined as systolic blood pressure

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(SBP)  $\geq 140$  mmHg and/or diastolic blood pressure (DBP)  $\geq 90$  mmHg or positive history of hypertension. Additionally, hypertension was classified into three grades (Grade 1 hypertension: SBP, 140 mmHg - 159 mmHg or DBP, 90 mmHg - 99 mmHg; Grade 2 hypertension: SBP, 160 mmHg - 179 mmHg or DBP, 100 mmHg - 109 mmHg; Grade 3 hypertension: SBP  $\geq 180$  mmHg or DBP  $\geq 110$  mmHg) [12]. Categorization of glycemic metabolism statuses was based on criteria of CDS including normal blood glucose (FPG  $< 6.1$  mmol/L), impaired fasting glucose (IFG) (FPG  $< 7.0$  mmol/L) and diabetes (FPG  $\geq 7.0$  mmol/L) [13].

The hypertensives with CHD had higher means of age, blood pressure levels, BMI and serum lipids (including TC and TG) and proportions of higher education levels, monthly income, alcohol consumption, psychological stress, family history of CHD, higher hypertension grades and more diabetes, but lower HDL than those without CHD (all  $p < 0.05$ ).

The prevalence of CHD was 4.21% in hypertensive patients. The rate may be underestimated because CHD was diagnosed by all medical institutions according to the corresponding diagnostic criteria based on medical history. The CHD rate with coexisting hypertension and diabetes mellitus was 5.24%, which was higher than that in patients with hypertension alone (4.11%) ( $\chi^2 = 9.91$ ,  $p < 0.05$ ) and those with IFG (4.13%) ( $\chi^2 = 5.28$ ,  $p < 0.05$ ). Furthermore, in the same glycemic status, the CHD rate increased with hypertension grades (all  $p < 0.05$ ). However, CHD rates do not



**Table 1:** The rate and risk of CHD in patients with hypertension.

	CHD rate (%)	$\beta$	SE	Wald $\chi^2$	<i>p</i> values	OR (95% CI)
Simple hypertension	4.11					1
Hypertension with diabetes	5.24	0.60	0.13	20.24	< 0.01	1.83(1.41 ~ 2.38)
Grade 1 hypertension normoglycemia	3.25					1
IFG	3.71	0.74	0.18	17.00	< 0.01	2.09(1.47 ~ 2.97)
Diabetes	4.45	1.46	0.23	40.45	< 0.01	4.28(2.74 ~ 6.71)
Grade 2 hypertension normoglycemia	4.14	0.45	0.09	24.96	< 0.01	1.57(1.32 ~ 1.88)
IFG	3.89	0.79	0.18	18.45	< 0.01	2.20(1.54 ~ 3.16)
Diabetes	5.30	1.76	0.25	50.65	< 0.01	5.83(3.59 ~ 9.48)
Grade 3 hypertension normoglycemia	5.54	0.96	0.14	48.62	< 0.01	2.62(2.00 ~ 3.44)
IFG	5.14	1.30	0.22	34.22	< 0.01	3.67(2.38 ~ 5.68)
Diabetes	6.05	2.61	0.36	52.96	< 0.01	13.64(6.75 ~ 27.56)

**Notes:** The effects of gender, age, education level, BMI, smoking, drinking, TC, TG, HDL, monthly income, psychological stress, family history of hypertension, and family history of CHD were adjusted.

present significant differences among glycemic metabolism statuses stratified by hypertension grades. And only among patients with grade 1 hypertension, the CHD rate shows an increasing trend with FPG levels elevating that approached statistical significance ( $p < 0.05$ ) (Table 1). It suggested that hypertension perhaps played a more important role in CHD than glycemic abnormality, or interaction of hypertension and glycemic abnormality existed, or other factors influenced the role (e.g. female, higher education levels, higher monthly incomings, drinking, psychological stress, TG and BMI, seen in supplementary table).

To determine the independent risk of hypertension grades and glycemic metabolic status on CHD, the multivariate logistic regression analysis was used. The presence of diabetes raised the risk of CHD in hypertensive population (OR = 1.83, 95%

CI: 1.14 - 2.38), further, the risks increased with the grades of hypertension (grade 1 hypertension: OR = 4.28, 95% CI: 2.74 - 6.71, grade 2 hypertension: OR = 5.83, 95% CI: 3.59 - 9.48, grade 3 hypertension: OR = 13.64, 95% CI: 6.75 - 27.56,  $\chi^2_{trend} = 42.73, p < 0.05$ ). In addition, the risk of CHD is elevated with glycemic metabolic status also, whatever the hypertension grades (Table 1). Therefore, to reduce the risk of CHD, targeted blood pressure lowering and early glycemic control should be administered simultaneously. It was noted that the hypertension grades are hard to precisely define because of antihypertensive drugs and different measurement conditions in this study which led to only reflecting the general trend.

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**Supplementary table:** CHD rates and risks based on the influence factors of CHD.

	CHD rate(%)	OR (95% CI)
Age (years)		1.00 (0.99~1.00)
Female	4.34	1.50(1.32~1.70)
College and above	2.60	1
High School/Secondary School	4.69	2.00(1.75~2.27)
Junior high school	6.52	2.96(2.56~3.42)
Primary school and below	8.21	3.98(3.33~4.77)
Monthly incomings $\leq$ 1000 (month/yuan)	3.27	1
(3000 (month/yuan)	5.19	1.58(1.42~1.77)
(5000 (month/yuan)	5.20	1.56(1.29~1.88)
(5000 (month/yuan)	4.93	1.44(1.20~1.89)
Smoking (yes)	4.34	0.99(0.84~1.17)
Drinking (yes)	5.26	1.32(1.12~1.56)
Psychological stress (yes)	8.92	2.50(2.21~2.82)
Family history of hypertension (yes)	4.54	1.16(0.89~1.51)
Family history of CHD (yes)	4.08	0.91(0.80~1.02)
Grade 1 hypertension	3.39	1
Grade 2 hypertension	4.22	1.42(1.22~1.66)
Grade 3 hypertension	5.55	2.38(1.85~3.08)
Normoglycemia	4.10	1
IFG	4.13	1.46(1.19~1.81)
Diabetes	5.24	3.62(2.52~5.20)
TC/(mmol/L)		0.99(0.95~1.05)
TG/(mmol/L)		1.03(0.98~1.07)
HDL/(mmol/L)		0.69(0.60~0.79)
Central obesity	4.35	1.06(0.95~1.17)
BMI/(kg/m <sup>2</sup> )		1.06(1.05~1.08)



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