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Original Article

A comparative analysis on pulse pressure and risk factors in impaired fasting glucose among Xinjiang Uygur, Kazakh and Han populations

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Abstract: Objective: This study aims to analyze pulse pressure (PP) and risk factors in impaired fasting glucose (IFG) among Xinjiang Uygur, Kazakh and Han populations. Method: A cross-sectional study was conducted in Xinjiang region on Uygur, Kazakh and Han populations aged 30-80 years old, 6928 individuals in total. IFG was screened and PP was measured along with the analysis of risk factors. Result: Of 2027 cases with IFG, average PP was 44.55 ± 14.212 mmHg. Specifically, the average PP was 41.02 ± 11.315 mmHg in Uygur population, 53.42 ± 16.979 mmHg in Kazakh population and 44.35 ± 14.013 mmHg in Han population. Pairwise comparisons indicated significant difference between three groups ($F=77.690$, $P<0.05$). The overall incidence of abnormal PP among all IFG populations was 51.9% (1053/2027), with males more prone to abnormal PP than females (64.8% vs. 35.2%). For each population, the incidence was 41.9% (257/614) in Uygur population, 71.5% (193/270) in Kazakh population and 52.8% (603/1143) in Han population. The incidence of abnormal PP was highest in Kazakh population and lowest in Uygur population, showing significant difference between the two populations ($x^2=66.618$, $P<0.05$). Logistic regression analysis indicated that the risk factors of abnormal PP among IFG populations on the whole were ethnic group, age, 2 h postprandial blood glucose (PPG), LDL, TC, TG and BMI. For Uygur population, the risk factors were age, LDL, TC and TC. For Kazakh population, the risk factors were age, PPG, LDL, TC and BMI. For Han population, the risk factors were age, LDL, TG and BMI. Conclusion: The overall incidence of abnormal PP among IGF populations in Xinjiang on the whole was 51.9%. The risk factors of abnormal PP included age, PPG, LDL, TC, TG and BMI. The common risk factors shared by the three populations were age and LDL. However, the risk factors varied for each population and LDL was the common, controllable risk factor for the three populations.

Keywords: Impaired fasting glucose, pulse pressure, risk factor

Introduction

Impaired fasting glucose (IFG) is a condition of pre-diabetes mellitus (PDM) and an independent risk factor of type 2 diabetes mellitus (T2DM) and coronary heart disease (CHD) [1]. For IFG population evolving towards PDM, adverse conditions of vascular endothelial cell dysfunction and cardiac contraction impairment are already present [2, 3]. Pulse pressure (PP) is an indicator of vasomotion. Either a too high or too low PP implies abnormal vascular function [4]. As demonstrated by clinical studies [5], the incidence of cardiovascular events in patients with abnormal PP is far higher than that in patients with normal PP. An increase of average PP is a predictor of poor prognosis in CHD [6], which may be also true for IFG. We performed a cross-sectional study on PP levels and risk factors in IFG patients of Uygur, Kazakh and Han ethnic groups in Xinjiang. The purpose was to provide clinical evidence for primary prevention of T2DM and CHD.

Materials and methods

Subjects

Cluster sample survey was performed in Urumqi and multistage sampling was performed in

Table 1. Distribution of the abnormal pulse pressure levels of patients with impaired fasting glucose in Xinjiang Uygur, Kazak and Han nationalities [n (%)]

Age (years)	Case n (M/F)	Uygur			Kazakh			Han		
		Male (M)	Female (F)	Total	Male (M)	Female (F)	Total	Male (M)	Female (F)	Total
30~45	468 (290/178)	36 (12.4)	42 (42.2)	78 (16.7)	25 (8.6)	44 (24.7)	69 (14.7)	229 (79.0)	92 (51.7)	321(68.6)
45~60	378 (229/149)	47 (20.5)	60 (40.2)	107 (28.3)	47 (20.5)	44 (29.5)	91 (24.1)	135 (59.0)	45 (30.2)	180 (47.6)
>60	207 (163/44)	48 (29.4)	24 (54.5)	72 (34.8)	32 (19.6)	1 (2.2)	33 (15.9)	83 (36.2)	19 (43.2)	102 (49.3)
Total	1053 (682/371)	131 (19.2)	126 (34.0)	257 (24.4)	104 (15.2)	89 (24.0)	193 (18.3)	447 (65.5)	156 (42.0)	603 (57.3)

Table 2. Logistic stepwise regression analysis of abnormal pulse pressure levels in patients with impaired fasting glucose in Xinjiang Uygur, Kazak and Han nationalities as a whole for risk factors

Variable	β	OR value	95% CI	P
Age	0.257	1.293	1.111~1.505	*<0.05*
2h PPG	0.055	1.056	1.016~1.098	*<0.05*
LDL	0.943	2.567	2.329~2.829	*<0.05*
TC	0.165	1.179	1.065~1.306	*<0.05*
TG	0.192	1.211	1.115~1.316	*<0.05*
BMI	0.025	1.025	1.002~1.048	*<0.05*
Ethnic group	0.370	1.448	1.211~1.731	*<0.05*

Kashi city and the surrounding counties from January 2011 to June 2012, targeting populations of Uygur, Kazakh and Han ethnic groups, 6928 individuals in total. They were aged 30-80 years old, including 2053 Uygur people, 2219 Kazakh people and 2656 Han people. The response rate was above 96%. The experimental protocol was approved by the ethics committee of the First Affiliated Hospital of Xinjiang Medical University. All patients signed the informed consent.

Method

Collection of demographic data and health questionnaire survey were performed by trained investigators. Blood pressure, height, weight and waist circumference (WC) were measured by using the established method. BMI was calculated. Laboratory indicators including FPG, TC, TG, LDL and OGTT 2 hPG were detected. Blood glucose was measured by glucose oxidase method. Blood lipids were measured by enzymatic colorimetric method. IFG was diagnosed by the following criteria [7-10]: 5.6 mmol/L≤FPG<7.0 mmol/L. High LDL-C, LDL-C≥3.37 mmol/L; high TC, TC≥5.18 mmol/L; high TG, TG≥1.7 mmol/L. Low BMI, BMI<18.5 kg/m^2; normal BMI, 18.5<BMI<24 kg/m^2; high BMI, 24≤BMI≤28 kg/m^2; obesity, BMI>28 kg/m^2. 2 h PPG was divided by the threshold of 11.1 mmol/L (≥11.1 mmol/L and <11.1 mmol/L). PP levels were divided into normal and abnormal, with 30 mmHg≤PP≤40 mmHg considered normal, and >40 mmHg or <30 mmHg abnormal.

Statistical analysis

SPSS 17.0 software was used for statistical process. Measurements were expressed as $\bar{x}$ ± s and counts as numbers of cases (percentages) [n (%)]. Analysis of variance was adopted for intergroup comparisons of measurements. Ratios were compared by a chi-square test. Risk factors were identified based on logistic stepwise regression.

Results

Distribution of abnormal PP levels among IFG patients of different ethnic groups with age and gender

Of three populations, 2027 cases were found with IFG. The average PP level was 44.55 ± 14.212 mmHg on the whole. For Uygur, Kazakh and Han populations, the average was 41.02 ± 11.315 mmHg, 53.42 ± 16.979 mmHg and 44.35 ± 14.013 mmHg, respectively. The incidence of abnormal PP among all IFG patients was 51.9% (257/614), with more males than females (64.8% vs. 35.2%). The incidence of abnormal PP among Uygur population was 41.9% (257/614), with more males than females (21.3% vs. 20.5%). The incidence of abnormal PP among Kazakh population was 71.5% (193/270), with more males than females (38.6% vs. 33.0%). The incidence of abnormal PP among Han population was 52.8% (603/1143), also with more males than females

Table 3. Logistic stepwise regression analysis of abnormal pulse pressure levels in patients with impaired fasting glucose in Xinjiang Uygur, Kazak and Hannationalities for risk factors

Variable	Uygur				Kazard				Han			
	β	OR	95% CI	P	β	OR	95% CI	P	β	OR	95% CI	P
Age	0.783	2.189	1.625~2.949	*<0.01*	0.632	1.882	1.034~3.425	*<0.05*	0.096	1.101	2.562~3.445	*<0.01*
PPG	0.034	1.035	0.964~1.111	*0.343*	0.699	2.011	1.406~2.878	*<0.01*	0.033	1.033	0.983~1.087	*0.198*
LDL	0.621	1.861	1.585~2.186	*<0.01*	0.938	2.555	1.767~3.695	*<0.01*	1.089	2.971	2.562~3.445	*<0.01*
TC	0.478	1.613	1.373~1.895	*<0.01*	0.414	1.513	1.023~2.239	*<0.05*	0.126	1.134	0.946~1.360	*0.173*
TG	0.260	1.298	1.136~1.483	*<0.01*	0.128	1.136	0.639~2.020	*0.663*	0.181	1.199	1.063~1.352	*<0.01*
BMI	0.019	1.019	0.972~1.068	*0.431*	0.131	1.140	1.022~1.271	*<0.05*	0.001	1.001	1.063~1.352	*<0.01*

(39.1% vs. 13.6%). PP levels were not significantly different between stratified age groups (**Table 1**).

Logistic regression analysis for risk factors of abnormal PP levels among IFG patients of different ethnic groups

Taking PP as dependent variable and ethnic group, age, 2 h PPG, LDL, TC, TG and BMI as independent variables, stepwise logistic analysis was performed for risk factors of abnormal PP. Among IFG populations on the whole, the risk factors were ethnic group, age, 2 h PPG, LDL, TC, TG and BMI. For Uygur population, the risk factors were age, LDL, TC and TC. For Kazakh population, the risk factors were age, PPG, LDL, TC and BMI. For Han population, the risk factors were age, LDL, TG and BMI (**Tables 2**, **3**).

Discussion

As a form of PDM, IFG is associated with a much higher risk of developing T2DM, which is 10 times of the risk for people with normal blood glucose. At this stage, the incidence of CHD and stroke, intimal medial thickness, atherosclerosis score, total death risk and risk of CHD-related deaths are all higher compared with people with normal blood glucose. PDM refers to the condition where glucose metabolism disorder does not evolve to the extent of DM. PDM and DM share similar pathogenesis and pathologies such as microangiopathy, macroangiopathy and nervous system damage already exist before the stage of DM.

Abnormal PP is one important risk factor for cardiovascular diseases. Even among those with effective hypertension control, abnormal PP is still associated with deaths related to cardiovascular diseases, especially in DM patients. ASCOT-CAFÉ found that PP was among the best predictors of cardiovascular events [11]. Therefore controlling PP and other risk factors is very important as early as in PDM stage in order to reduce the cardiovascular risk for DM patients. According to previous epidemiological surveys [12], the proportion of PDM patients in Xinjiang is higher than the average level in inland China. In Xinjiang, the incidence of PDM combined with hyperuricemia, metabolic syndrome, hypertension/prehypertension and obesity is 30.3%, 58.3%, 88% and 35.4%, respectively. However, epidemiological evidence relating to abnormal PP and risk factors for these populations is still lacking. As indicated by our survey in Xinjiang for IFG populations belonging to different ethnic groups, the overall incidence of abnormal PP among all IFG populations surveyed was 51.9% (1053/2027), which was much higher than in those without IFG. The former was faced with a greater risk of cardiovascular and cerebrovascular diseases. The incidence of abnormal PP varied between the three ethnic groups. Logistic regression showed that the risk factors of abnormal PP also varied for IFG populations of different ethnic groups, due to the influence of genetics, life style and dietary structure. Therefore, for different ethnic groups, different countermeasures should be implemented to control the risk factors, so as to reduce the risk of abnormal PP and cardiovascular and cerebrovascular diseases. We found that for IFG population of Uygur ethnic group, LDL, TC and TG were the risk factors to be controlled. For Kazakh population, besides LDL and TC, BMI and PPG were also worthy of attention. For Han population, the risk of abnormal PP can be reduced by controlling LDL, TG and BMI. Moreover, gender was another risk factor of abnormal PP among IFG populations of different ethnic groups, with males more prone to

the risk than females. So for males with IFG, efforts should be made to change the life style and to control blood lipid levels and BMI, which are the risk factors of abnormal PP and cardiovascular and cerebrovascular diseases.

To conclude, abnormal PP is one risk factor of cardiovascular and cerebrovascular diseases among IFG populations. The risk factors of abnormal PP were BMI, 2 h PPG, LDL, TC and TG, among which LDL was the common risk factor shared by IFG populations of different ethnic groups. Therefore, controlling LDL is the key countermeasure for reducing the risk of abnormal PP and cardiovascular and cerebrovascular diseases for all three ethnic groups.

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Disclosure of conflict of interest

None.

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