Factors associated with β cell function and changes of β cell function along with duration of diabetes among patients with type 2 diabetes

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Objective: The aim of the multicenter study was to analyze changes of β cell function along with duration of diabetes and the association between hypoglycemic therapies, antihypertension therapies, lifestyle factors and β cell function among patients with type 2 diabetes. Homeostasis Model Assessment of Beta Cell Function (HOMA-β) was used to evaluate β cell function.

Methods: From April 2016 to November 2016, patients were enrolled from endocrinology department of Jiangsu Province, He'nan Province, Shanxi Province and Sichuan Province. Self-designed case report form was applied to collect data including general information, disease situation, therapy, laboratory examination, blood glucose records in hospital and inpatient's information.

Results: 4815 patients were enrolled in the present study, 1692 patients were from Jiangsu Province. 781 patients were from He'nan Province. 1757 patients were from Shanxi Province and 585 were from Sichuan Province. The mean age of the sample was 49. There were significant differences in fasting serum insulin (FINS), HOMA-β, fasting blood glucose and 120 min blood glucose in patients with different durations of diabetes ($P<0.001$). Along with prolonging of duration, FINS and HOMA-β decreased ($P<0.001$, $P=0.002$) while blood glucose and 120 min blood glucose increased ($P<0.001$). Take patients whose diabetes duration <1 year as reference, when the duration of diabetes reached 10 years and 19 years, β cell function decreased by 13.32% and 37.91 % ($P<0.001$) with a 2% annual rate of decline. Adjusting for age, duration of diabetes, body mass index (BMI), glycosylated hemoglobin A1c (HbA1c) in regression analysis, sulfonylureas, Dipeptidyl peptidase-4 (DPP-4) inhibitors, Angiotensin II receptor antagonist (ARB) affected β cell function ($P=0.002$, $P=0.008$, $P=0.034$, respectively).

Adjusting for duration of diabetes, BMI, HbA1c in regression analysis, smoking resulted in decreased β cell function ($P=0.035$).

Conclusions:

- 1. With the development of the duration of diabetes, β cell function in patients with type 2 diabetes decreased with a 2% annual rate.
- 2. Longer duration of diabetes lead to higher levels of fasting blood glucose and 120 min blood glucose.
- 3. Sulfonylureas increased β cell function deterioration while DPP-4 inhibitors improved β cell function in hypoglycemic therapies.
- 4. In antihypertension therapies, ARB had positive effects on β cell function.
- 5. Smoking lead to β cell function decline, it is recommended that type 2 diabetes patients should take a reasonable way to quit smoking to reduce damages of nicotine on β cell function.

Key words: type 2 diabetes; β cell function; duration of diabetes; hypoglycemic therapies; antihypertension therapies; lifestyle

Table 1 Multiple linear regression model of blood glucose treatment and islet β cell function

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.515	0.242	6.265	<0.001
Sulfonylureas	-0.054	0.018	-3.088	0.002
DPP-4 Inhibitors	0.283	0.107	2.645	0.008

Note: Adjust the duration of diabetes, age, BMI and HbA1c.

Table 2 Multiple linear regression model of blood glucose treatment and islet β cell function

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.773	0.152	11.637	<0.001
ARB	0.057	0.027	-2.123	0.034

Note: Adjust the duration of diabetes, age, BMI and HbA1c.

Table 3 Unary linear regression model of smoking and islet β cell function

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.750	0.052	33.43	<0.001
Smoking	-0.020	0.009	-2.112	0.035

Note: Adjust the duration of diabetes, age, BMI and HbA1c.

Figure 1 Comparison of HOMA-β in T2DM patients with different course of disease

Figure 2 The percentage of decline of HOMA-β in T2DM patients along with different course of disease