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ORIGINAL ARTICLE

Statistical Analysis on Threshold of Haemoglobin A1C (HBA1c) for Diabetes Diagnosis and the Relationship Between HBA1c and Plasma Glucose Concentrations in Chinese Diabetic High-Risk Groups

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SUMMARY

Background: **The goal is to evaluate the threshold of hemoglobin A1C (HBA1c) for screening test among Chinese patients with diabetes and high-risk groups in the endocrinological department and identify the relationship between HbA1c and plasma glucose.**
Methods: **Experimental design: This study is based on the data selected from patients without clinical intervention enrolled in the Endocrinology Department and Admission Office in our hospital. It uses the four-point plasma glucose modeling and trapezoidal integration method to analyze the relationship between HbA1c and each plasma glucose threshold in an oral glucose tolerance test (OGTT).**
Setting: Harbin, China, from January 1st of 2010 to December 31st of 2012.
Participants: 2,853 16 - 85 year-old patients who came to our Endocrinology Department to take venous blood measurements and OGTT.
Selection criteria: The OGTT and HbA1c were performed simultaneously, unless acidosis was present, without considering past history of diabetes and oral hypoglycemic drugs or insulin treatment, or other basic combined diseases. Pregnant patients were excluded.
Results: **The area under the receiver operating characteristics curve (ROC) was 0.902 (95% confidence interval 0.890 to 0.914) for HbA1c alone and 0.915 (0.906 to 0.925) for fasting plasma glucose (FPG) alone. The HbA1c threshold of 6.5% showed the highest Youden index of 64.4%, and significantly higher sensitivity (81.1%, 79.3% to 82.7%) than FPG ≥ 7.0 mmol/L (69.8%, 67.8% to 71.8%) ($p < 0.0001$) and higher specificity (83.3%, 80.4% to 85.8%) than HbA1c ≥ 6.3% (76.3%, 73.2% to 79.3%) ($p < 0.0001$) in detecting diabetes, together with a low negative likelihood ratio of 0.2. In addition, the threshold of 1/2 hour postprandial glucose and that of 1 hour postprandial glucose are 10.6 mmol/L and 13.6 mmol/L, respectively. Thus, the relative contribution of FPG increased gradually with increasing levels of HbA1c: 15.9% in the lowest vs. 44.0% in the highest quintile ($p < 0.001$). The relative contribution of 1-hour postprandial glucose decreased progressively from the lowest (25.0%) to the highest quintile of HbA1c (14.2%, $p < 0.001$).**
Conclusions: **These findings suggest that the optimal HbA1c threshold of 6.5% as a screening criterion for diabetes and high-risk groups may be acceptable. This paper is trying to put forward the thresholds of 1/2-hour plasma glucose and 1-hour plasma glucose for diagnosing diabetes. The relative contribution of FPG increased gradually with increasing levels of HbA1c; however, the contribution of postprandial glucose decreased progressively.**
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Supplementary Table and Figure.

Table 1. Positive likelihood ratio of HbA1c (n = 2,853).

HbA1c	Diabetes		IGR or N		Positive likelihood ratio
	n	%	n	%	
< 5.9	91	4.4	375	49.0	0.1
5.9 - 6.1	105	5.0	137	17.9	0.3
6.2 - 6.4	148	7.1	105	13.7	0.5
6.5 - 6.7	183	8.8	64	8.4	1.0
6.8 - 7.0	199	9.5	40	5.2	1.8
7.1 - 7.3	164	7.9	24	3.1	2.5
7.4 - 7.5	131	6.3	6	0.8	7.8
7.6 -	1,067	51.1	14	1.8	28.4
Total	2,088	100	765	100	

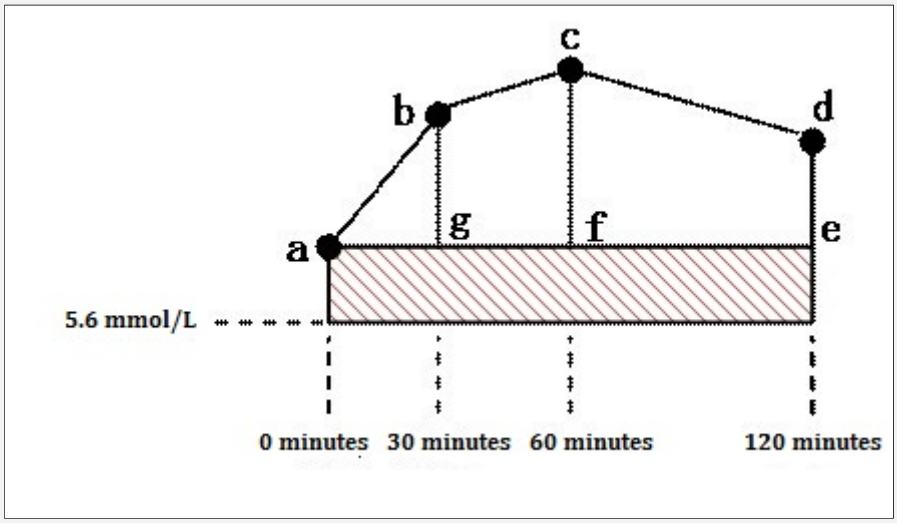

Figure 1. The white part is AUC1; the whole part over 5.6 mmol/L is AUC2; the shaded is (AUC2 - AUC1).