Application of Capillarys 2 Flex Piercing HbA1c measurement system for alpha and beta-thalassemia screening

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Background

HbA_{1c} is a widely used biomarker for the management of diabetes mellitus because it provides valuable information for long-term glycemic control and assessment of the patient's risk for chronic complication. Recently, the test has been recommended for use in diagnosing diabetes [1]. Therefore, accurate and precise measurement of HbA_{1c} is extremely important. The measurement of HbA_{1c} values can be affected by hemoglobin disorders such as hemoglobinopathies and thalassemia. Recent studies showed that β-thalassemia could directly affect the measurement of HbA_{1c} values, similar to other known analytical interferences (e.g., carbamylated hemoglobin, fetal hemoglobin, and acetylated hemoglobin) [2]. The assays which are incapable of identifying thalassemia would report misleading HbA_{1c} values for thalassemia patients whose red blood cell life span is decreased [3].
The thalassemia is quite prevalent, especially in the southern region of the country. In the Guangdong province, 12.03%, 3.80% and 0.63% of individuals are carriers of α-thalassemia, β-thalassemia and combined α-/β-thalassemia respectively. The genotype of 51.7% of all α-thalassemia is $--^{sea}/\alpha\alpha$. [4]

Material & Methods

The measurement of HbA_2 is used for thalassemia screening usually based on the accurate determination by using long separation programs on IE-HPLC or CE instruments. Recently, the HbA_{1c} assay on the Capillarys2 Flex Piercing (C2FP) system has been shown to separate and quantify the HbA_2 fraction as well as the HbA1c detection and providing both HbA_{1c} values and HbA_2 values at the same time, thus allowing for the incidental detection of β-thalassemia [5]. In this study, we evaluated the application of C2FP HbA_{1c} system for screening thalassemia.
This study was approved by the Ethics Committee of Peking University Shenzhen Hospital. Whole blood samples from 258 healthy adult patients without hemoglobin disorders, 80 α-thalassemia adult patients with $--^{sea}/\alpha\alpha$ genotype, and 225 adult patients with minor β-thalassemia were collected in ethylene diamine tetraacetic acid (EDTA)-containing tubes. The samples with iron deficiency were excluded. All samples were measured using C2FP HbA_{1c} system (Sebia, Lisses, France) and Capillarys2 hemoglobin system (Sebia, Lisses, France).
All statistical analyses were carried out using SPSS software version 19.0.
The correlation between the HbA_2 values determined by two systems was assessed using Pearson's correlation. Receiver operating characteristic curve (ROC) were performed to determine the cut-off values of HbA_2 for screening α and β thalassemia.
ROC analysis of HbA_2 were performed using 258 healthy adult patients and 80 α-thalassemia adult patients with $--^{sea}/\alpha\alpha$ genotype and 225 adult patients with β-thalassemia with 10 common genotypes.
For screening samples with α thalassemia, the optimal HbA_2 cut-off value of the C2FP HbA_{1c} system is 2.35% with the area under curve (AUC) 0.969, sensitivity 88.1% and specificity 92.5%, and the optimal HbA_2 cut-off value of the Capillary2 hemoglobin system is 2.55% with AUC 0.951, sensitivity 90.9%% and specificity 88.6%. Fig 1 (A and B) shows the details.

Results

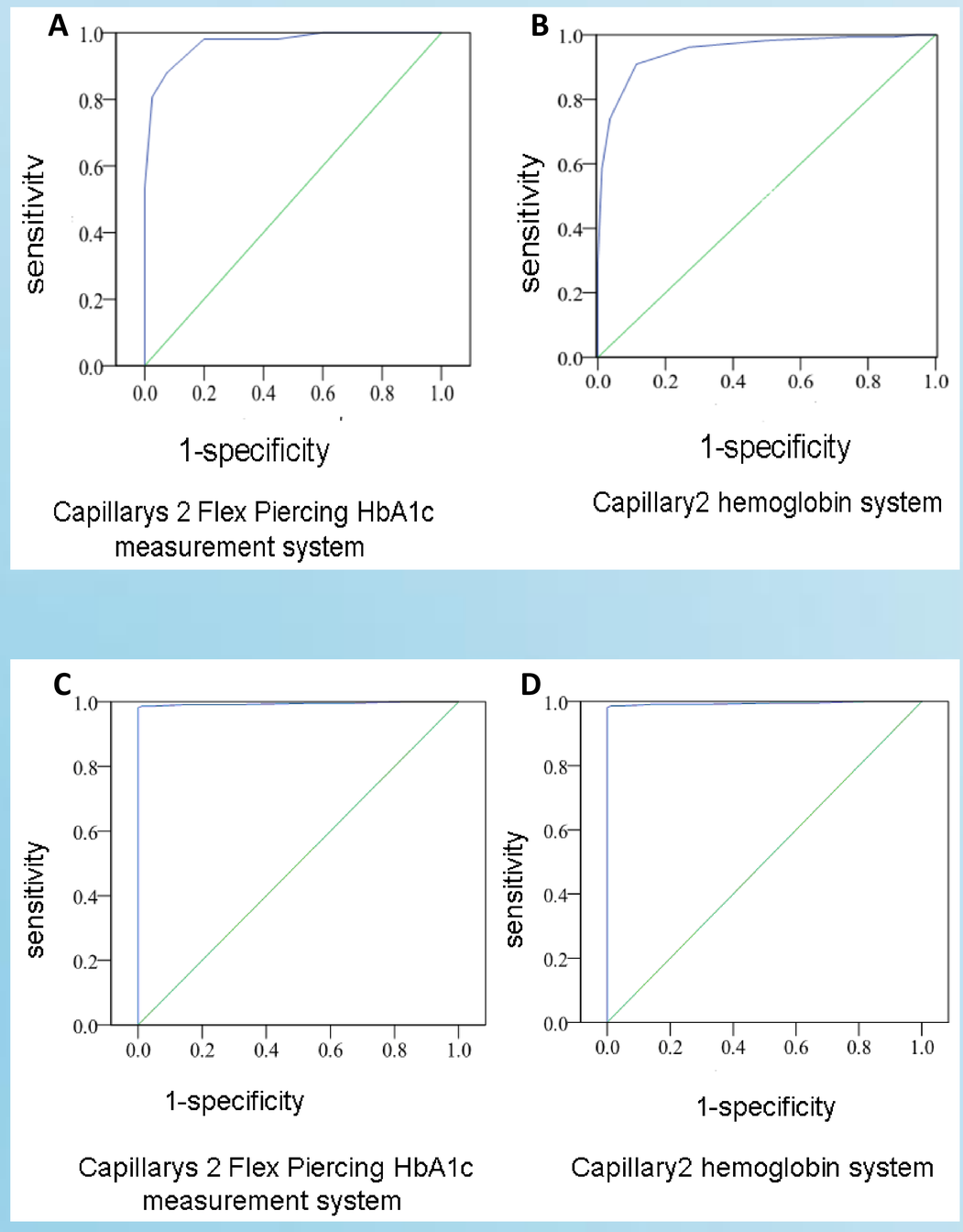

Fig 1: ROC curve for C2FP HbA_{1c} system (A) and Capillary2 hemoglobin system (B) for α thalassemia screening. ROC curve for C2FP HbA_{1c} system (C) and Capillary2 hemoglobin system (D) for β thalassemia screening.

For screening samples with β thalassemia, the optimal HbA_2 cut-off value of the C2FP HbA_{1c} system is 3.38% with the AUC 0.994, sensitivity 100% and specificity 98.2%, and the optimal HbA_2 cut-off value of the Capillary2 hemoglobin system is 3.75% with AUC 0.993, sensitivity 98.2%% and specificity 100%. Fig 1 (C and D) shows the details.
Many scientific publications have already demonstrated that the Capillarys 2 Flex Piercing is a robust and reliable system for the measurement of HbA1c in presence of hemoglobin variants. Thanks to its high resolution power with a clear separation and accurate quantification of the HbA2 fraction, it can also provide valuable information to clinicians for potential a and b-thalassemia contexts in diabetic patients while measuring HbA_{1c}. The HbA_2 values of the C2FP HbA_{1c} system can be used to screen doubtful thalassemia samples without other prescription.

CONCLUSION

The CAPILLARYS 2 FLEX PIERCING HbA1c system can separate and accurately measure HbA2 values for screening thalassemia besides reporting accurate HbA1c value, which provides valuable information to clinicians for the interpretation of the HbA1c result in patients with thalassemia trait.

References

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