

Diabetic Monitoring in Sickle Cell Anemia Patients
By Markita Wilburn, PharmD Candidate
Hampton University School of Pharmacy

HbA1c (A1C) measures the binding of circulating glucose to hemoglobin. Higher levels of glucose in the blood contribute to more binding, and consequent higher levels of glycosylated hemoglobin. A1c testing is the “gold standard” of diabetes management—so is diabetic monitoring possible in patients with abnormal hemoglobin content?

Sickle cell anemia, or sickle cell trait, is a hereditary disorder of the blood. It is a form of anemia distinguished by the presence of sickled hemoglobin (HgS) in circulation of RBCs.¹ Such genetic variants of hemoglobin can affect the accuracy of HbA1c measurements. Because erythrocytes are freely permeable to glucose, the level of glycosylated hemoglobin in a blood sample provides a glycemic history of the previous 120 days, the average erythrocyte life span.² However in sickle cell anemia, the number of RBCs is low because sickled cells have shorter life spans of about 10 to 20 days.³ Any condition that shortens erythrocyte survival will falsely lower HbA1c test.⁴ With some assay methods, A1C in patients with hemoglobinopathies result in falsely high outcomes.⁵ As a consequence, the actual average of blood glucose levels over the previous 3 months is overestimated. Therefore, the hemoglobin A1C test can lead to false outcomes resulting in over-treatment or under-treatment of diabetes in patients with inherited hemoglobin variants.

Reliable A1C tests, in which hemoglobin variants do not cause interference, are available. For example hemoglobin S (HgS) and E (HgE) are prevalent variants in people of African, Mediterranean, or Southeast Asian descent^{5,6}, yielding false results in A1c. Alternative forms of testing such as glycated serum protein (fructosamine) should be considered for these patients.⁴

African Americans have an increased risk of inheriting the sickle cell trait. The sickle cell trait is a disorder in which individuals have both hemoglobin A (HgA); the usual form of hemoglobin, in addition to hemoglobin S (HgS); a variant. It is evidenced that 1 in 12 African Americans have the sickle cell trait. Moreover, 14.7 percent of African Americans aged 20 years of age, or older have diabetes.^{5,7} Such confers that many African Americans have both diabetes as well as the sickle cell trait.⁵ As a result, African Americans represent a population that warrants frequent interferences in diabetic monitoring.

The National Glycohemoglobin Standardization Program (NGSP) provides information of alternative assays for diabetic monitoring in patients with inherited hemoglobin variants in which an accurate A1C result cannot be obtained. Alternative measures of average blood glucose concentrations can be monitored using the fructosamine test, also called glycated serum protein or glycated albumin. Limitations however exist. Although serum protein tests can be used to estimate circulating blood glucose over a period time, it is however for a much shorter period, usually over previous 2 to 3 weeks.⁵ In all but one study, fructosamine demonstrated moderate to strong correlation with A1C results and was recommended for use in cases of patients with hemoglobinopathy.⁸

Due to the interferences observed in A1C reliability of patients with inherited genetic variants, ongoing glycemic control in patients with hemoglobinopathy and diabetes should be evaluated using an alternate method. Studies continue to support the fact that A1C is preferred assessment of glycemic management in patients with diabetes. However, in cases in which a patient has a know hemoglobinopathy, such as Sickle Cell Anemia (Hgs), quarterly monitoring of glycemic control using fructosamine will provide more reliable information.⁸ This is turn ensures meticulous evaluation of patient specific blood glucose levels creating the most appropriate treatment regimens.

References

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