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Failure of Glucose Monitoring in an Individual with Pseudohypoglycemia

Kimberley T. Lee, MD and

Internal Medicine Residency Program, School of Medicine, Johns Hopkins University, Baltimore, Maryland

Peter M. Abadir, MD

Division of Geriatric Medicine and Gerontology, School of Medicine, Johns Hopkins University, Baltimore, Maryland

To the Editor

In June 2013, a 65-year-old African-American woman with a history of embolic stroke and non-insulin-dependent diabetes mellitus presented to the hospital with a chief complaint of new acute right facial numbness, facial droop, and right upper extremity weakness. She was admitted to the intensive care unit because it was suspected that she was having an acute stroke. She was found to have persistent severe hypoglycemia, with fingerstick blood sugar (FSBS) ranging from 10 to 40 mg/dL. She was kept on a continuous dextrose drip. Her glycosylated hemoglobin (HbA1C) was 2.6%. Extensive examination for endocrine causes of hypoglycemia was essentially negative. Despite her extremely low FSBS readings, she remained mostly asymptomatic except for mild dizziness. Given the discrepancy between laboratory data and clinical pictures, all her glucose readings were reviewed, revealing discordance between her basic metabolic panel (BMP) and FSBS readings (Figure 1). Her glucose readings on BMP were always greater than 70 gm/dL, despite extremely low FSBS. A simultaneous FSBS and BMP confirmed the diagnosis of pseudohypoglycemia. Ear lobe blood sugar measurements were concordant with the BMP readings. Further examination confirmed the diagnosis of mixed connective tissue disease with features of scleroderma that were thought to have contributed to her falsely low FSBS. Her low HbA1C readings were attributed to severe anemia.¹

Pseudohypoglycemia is a phenomenon wherein the capillary blood glucose measured according to FSBS is significantly lower than BMP glucose readings. Review of the literature revealed six similar case reports: three women with Raynaud syndrome, one woman with acrocyanosis, one woman with Eisenmenger syndrome, and one man with severe peripheral vascular disease.^{2,3} All of these people were asymptomatic with normal to high BMP glucose. Warming the extremities normalized FSBS in the women with

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acrocyanosis and Raynaud syndrome. The alternate sites of earlobe and forearm for glucometer checks revealed a glucose level that correlated well with plasma glucose for three of these individuals. A case series of people in shock revealed that FSBS readings were 67.5% lower than BMP glucose values, with 32% of them being incorrectly diagnosed with hypoglycemia.⁴

The pathophysiology of pseudohypoglycemia according to FSBS is thought to be low capillary blood flow effectively lowering the glucose supply and continued glucose extraction by the surrounding tissues leading to low peripheral glucose levels. In shock, there is terminal vasoconstriction, and in Raynaud syndrome and acrocyanosis, there is thought to be upregulation of alpha-adrenergic receptors leading to excessive peripheral vasoconstriction in the setting of cold or strong emotions.³ Eisenmenger syndrome is associated with disease of the microcirculation, and peripheral vascular disease causes a physical decrease in peripheral blood flow due to atherosclerotic lesions.⁵

Diabetes mellitus is a common clinical syndrome that increases the risk of poor health outcomes, including stroke, myocardial infarction, kidney failure, and mortality. The cornerstone of self-monitoring of blood glucose is using FSBS, test strips, and portable meters. With high levels of sensitivity and accuracy, virtually every individual with diabetes mellitus has used a portable meter since their inception 3 decades ago. A central problem is how to choose an alternative way to measure and track blood glucose in individuals with diabetes mellitus in whom portable meters fail to measure blood sugar accurately (Figure 1).

This case illustrates the importance of putting laboratory results in the context of clinical presentation. A clinical history is necessary for a diagnosis of hypoglycemia as defined according to the Whipple triad: symptoms or signs of hypoglycemia, plasma glucose less than 55 mg/dL, and resolution of symptoms with restoration of normal glucose levels. Clinicians should consider disease of the microcirculation when confronted with low FSBS in asymptomatic individuals and corroborate this value using an earlobe stick, venous blood on glucometer, and or plasma glucose before initiating costly examination. This case may represent the tip of the iceberg and raises concerns about the utility of FSBS measurement in proper management of individuals with diabetes and peripheral vascular disease.

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Figure 1.

Fingerstick blood sugars (FSBS) versus basic metabolic panel (BMP) glucose over time. This line graph illustrates the discrepancy between fingerstick blood sugars measurements to BMP glucose at different points in time.