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Discrepancy Between Fingertip Glucose Levels and HbA1c in an Adolescent with Diabetes: A Fake Logbook or Pseudohypoglycemia?

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Adolescence is a period characterized by various biological, psychological, and behavioral changes, including some difficulties in the management and self-care of diabetes among adolescents with type 1 diabetes mellitus (T1D).[1] Reporting blood glucose levels lower than those measured from the fingertip to mislead the parents and healthcare professionals can also be seen as a behavioral problem.[2,3] However, a mismatch between capillary glucose measurements and HbA1c values may also occur due to erroneous capillary glucose measurements due to endogenous problems, though rarely.

Pseudohypoglycemia is a term used to describe an artificially low blood glucose level. Apart from the venous measurement errors due to hematological disorders such as erythrocytosis or leukemia[4] and/or false hypoglycemia due to delayed evaluation of the blood tests, peripheral vasoconstriction caused by Raynaud's phenomenon, acrocyanosis, and shock may cause capillary measurement errors.[5]

Raynaud's phenomenon is a condition that causes vasoconstriction due to the upregulation of alpha-adrenergic receptors in stressful situations such as exposure to cold weather, anxiety, and fear. It usually causes coldness in the fingers and toes, followed by changes in skin color.[6] Disruption in digital microcirculation due to vasoconstriction causes prolongation of blood circulation time in capillaries and increased glucose consumption by tissues.[4,6]

Although mostly seen as a primary idiopathic condition in adolescents, the Raynaud's phenomenon could be a sign of underlying rheumatologic conditions, including connective tissue diseases or vasculitides.

A 15-year-old male, who had been followed up with a diagnosis of T1D for 5 years, was admitted to our pediatric hospital. He was treated with insulin at 1.86 U/kg/day. Although it was stated that capillary glucose measurements were mostly in the range of 70-200 mg/dL, HbA1c levels were between 10% and 14% in the last 2 years. It was suspected that the boy reported lower blood glucose levels to mislead his parents and diabetes team. He was then hospitalized, and fingertip glucose monitoring was performed in another hospital. Inpatient blood glucose measurements also tended to be low or normal, as it was previously reported by him. Severe episodes of hypoglycemia have been noted, especially when the patient is excited. The physical examination in the outpatient clinic showed that his height, weight, and BMI Z-scores were 0.45, 0.95, and 0.82 standard deviation score (SDS), respectively. Lipohypertrophy was present in the abdominal region and arms. Coldness and discoloration were noticed on the fingers and toes. Considering Raynaud's phenomenon, he was referred to the rheumatology department to clarify an underlying etiological cause. In the family history, fibromyalgia in his mother and an unclear rheumatic disease in his father were noted. Laboratory evaluation showed an HbA1c level of 11.5%. Due to the marked Raynaud phenomenon noticed during the physical examination, the autoantibodies have been evaluated and

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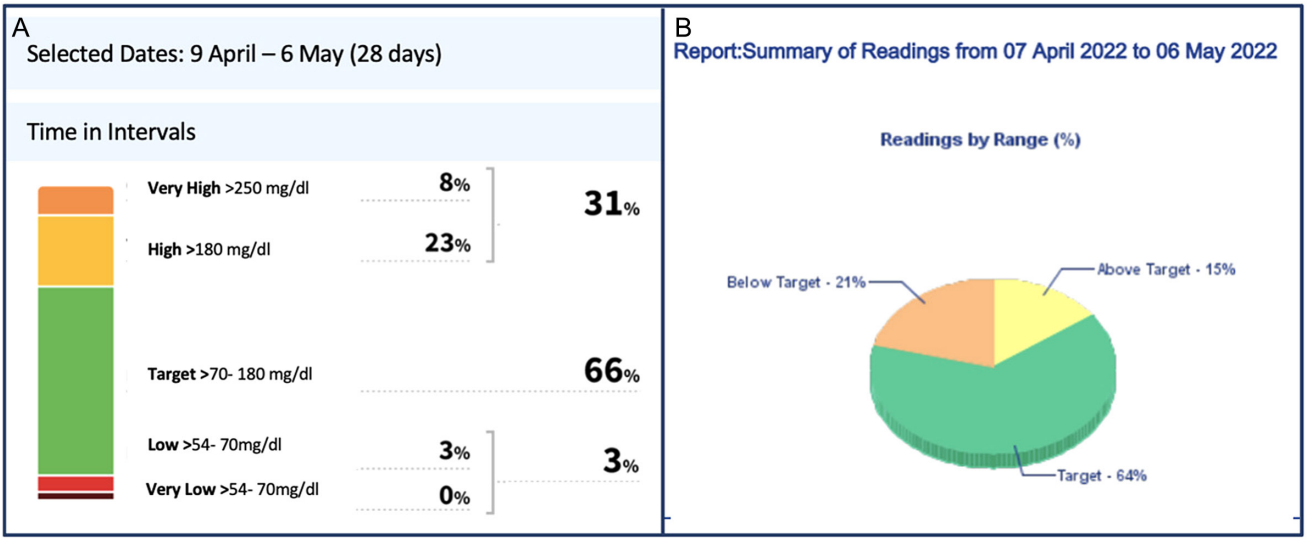

Figure 1. (A) A simultaneous continuous glucose monitoring and (B) capillary glucose monitoring data of the patient during April.

recorded as negative [ANA (antinuclear antibody), anti-double-strand DNA, ENA (extractable nuclear antibody) profile].

The use of a continuous glucose monitoring system (CGM) was recommended simultaneously with capillary measurements. When glycemic parameters, CGM data, and capillary glucose measurements of the same time intervals were compared during follow-up, it was found that the time spent under the target with capillary glucose measurement was 21%, while the time below range (TBR) observed in the CGM was 3% (Figure 1). With the diagnosis of primary Raynaud's phenomenon, calcium-channel blocker therapy was started, and avoiding cold exposure was recommended.

A limited number of cases of pseudohypoglycemia caused by blood circulation disorders such as Raynaud's phenomenon, acrocyanosis, shock, Eisenmenger syndrome, and leukocytosis have been reported.[7] In cases of Raynaud's phenomenon, peripheral circulation disorders occur, especially as a result of peripheral vasoconstriction caused by cold and emotional stress. It is believed that capillary glucose measurements are low as a result of a decrease in capillary blood flow and consequently, decrease in the passage of glucose to the capillary vessels.[8] Raising awareness of pseudohypoglycemia is important not only to avoid unnecessary examinations and treatment but also to prevent anxiety associated with the belief of having a medical condition that seems insoluble. Pseudohypoglycemia should be kept in mind, especially in cases with diabetes where venous glucose and HbA1c values are found to be high despite repeated low capillary glucose measurements. Raynaud's phenomenon should be considered in the differential diagnosis of pseudohypoglycemia, especially in patients during the period of adolescence with a history of cold exposure and emotional stress.

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