Interference of Intravenous Vitamin C With Blood Glucose Testing

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Self-monitoring of blood glucose (SMBG) is an integral component in the management of diabetes. However, it is important to understand the limitations of SMBG due to presence of interfering substances (1). We present a patient with diabetes and malignancy, who had falsely elevated blood glucose readings following administration of intravenous ascorbic acid (AA).

A 56-year-old woman with type 1 diabetes was diagnosed with metastatic pancreatic neuroendocrine tumor. She administered insulin glargine and insulin aspart before meals. After three cycles of chemotherapy, due to poor response, she decided to stop further traditional therapies. She consulted a naturopath, who started her on intravenous AA at a dose of 75 g twice weekly. Following this, she noted that her SMBG levels were consistently elevated after intravenous AA. She presented to the University of Washington where her SMBG downloads were reviewed. On the days she received intravenous AA infusion, the average blood glucose was 26.9 ± 4.8 mmol/L, compared with an average of 12.36 ± 2.7 mmol/L on other days. She was using glucose oxidase (GOD)–based strips (OneTouch, LifeScan, Inc., Milpitas, CA) for her SMBG. We suspected interference with AA in the measurement of blood glucose using GOD-based strips and recommended that she measure her blood glucose using glucose dehydrogenase-flavin adenine dinucleotide (GDH-FAD)–based strips (Bayer Contour, Tarrytown, NY). She was advised not to change her insulin doses. A written log comparing the two chemistries with the same blood sample confirmed significantly higher glucose levels with the GOD strips. Unfortunately, the patient died before we could download the meter or compare blood results with a hospital laboratory.

AA is used as an alternate or adjuvant to chemotherapy or radiotherapy in oncology patients. AA at high concentrations (1,000–5,000 μmol/L), achieved by intravenous route, is prooxidant and generates hydrogen peroxide–dependent selective cytotoxicity to cancer cells in vitro (2). AA can cause interference with both GOD- and GDH-FAD–based electrochemical strips by oxidization at the electrode surface, resulting in the production of more electrons and falsely elevated blood glucose reading (3). Use of mediator with complex chemistry and high chemical selectivity limits the potential for such interference (in this case phenothiazine instead of ferricyanide). Intravenous AA is eliminated by simple first-order kinetics and has a half-life of 2.0 ± 0.6 h (4). Hence, it would be preferable to wait at least 8–10 h after intravenous AA, prior to glucose monitoring with GOD strips. Though serum concentration of AA at which interference occurs is not well defined, levels associated with regular oral use (88–176 μmol/L) have not been shown to affect the readings.

Interfering substances for SMBG test strips with the new U.S. competitive bidding program is of concern since the chemistry of the off-brand strips used may not be clear to the clinician.

Correction of falsely high blood glucose level with excess insulin may cause hypoglycemia and death. It is critical for providers and patients to be educated on the differences between various glucose test strips in their susceptibility to interfering substances.

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