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CLINICAL APPLICATIONS

Glucose Meters: A Review of Technical Challenges to Obtaining Accurate Results

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Abstract

Glucose meters are universally utilized in the management of hypoglycemic and hyperglycemic disorders in a variety of healthcare settings. Establishing the accuracy of glucose meters, however, is challenging. Glucose meters can only analyze whole blood, and glucose is unstable in whole blood. Technical accuracy is defined as the closeness of agreement between a test result and the true value of that analyte. Truth for glucose is analysis by isotope dilution mass spectrometry, and frozen serum standards analyzed by this method are available from the National Institute of Standards and Technology. Truth for whole blood has not been established, and cells must be separated from the whole blood matrix before analysis by a method like isotope dilution mass spectrometry. Serum cannot be analyzed by glucose meters, and isotope dilution mass spectrometry is not commonly available in most hospitals and diabetes clinics to evaluate glucose meter accuracy. Consensus standards recommend comparing whole blood analysis on a glucose meter against plasma/serum centrifuged from a capillary specimen and analyzed by a clinical laboratory comparative method. Yet capillary samples may not provide sufficient volume to test by both methods, and venous samples may be used as an alternative when differences between venous and capillary blood are considered. There are thus multiple complexities involved in defining technical accuracy and no clear consensus among standards agencies and professional societies on accuracy criteria. Clinicians, however, are more concerned with clinical agreement of the glucose meter with a serum/plasma laboratory result. Acceptance criteria for clinical agreement vary across the range of glucose concentrations and depend on how the result will be used in screening or management of the patient. A variety of factors can affect glucose meter results, including operator technique, environmental exposure, and patient factors, such as medication, oxygen therapy, anemia, hypotension, and other disease states. This article reviews the challenges involved in obtaining accurate glucose meter results.

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Abbreviations: (ADA) American Diabetes Association, (ARM) Ames Reflectance Meter, (SMBG) self-monitoring of blood glucose, (YSI) Yellow Springs Instrument

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