LETTER TO THE EDITOR

Point-of-care Glucose Monitoring in COVID-19 Intensive Care Unit: How's It Different?

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Keywords: Blood glucose monitoring, COVID-19, Glucose control.
Indian Journal of Critical Care Medicine (2021): 10.5005/jp-journals-10071-24037

Sir,

Symptomatic coronavirus disease-2019 (COVID-19) patients commonly present with fever, cough, and shortness of breath which may ultimately lead to acute respiratory distress syndrome and severe hypoxia refractory to oxygen therapy.[1] Based on available pieces of evidence, use of systemic corticosteroids is recommended for 7–10 days in severe and critical COVID-19 patients. However, steroids increase blood glucose levels by increasing hepatic gluconeogenesis, blocking the action of insulin and increasing insulin resistance, reducing uptake of glucose by the muscles and adipose tissue and it may even reduce the action of beta cells directly. Moreover, COVID-19 itself can cause new-onset diabetes in high-risk and susceptible population as an extrapulmonary complication and can worsen blood sugar control in those with preexisting diabetes.[2] Hence, regular monitoring of blood glucose becomes crucial in the management of these patients.

Glucometers are simple, portable, and convenient blood sugar monitoring devices that are used for point-of-care management. This simple tool can at times be misleading if the sources of error in measurements are overlooked. There are a number of factors that can influence the accuracy of blood glucose strips. Altitude, temperature, oxygen concentration, hematocrit of the patient, triglyceride levels, blood levels of xylose, galactose, uric acid, and acetaminophen are among them.[3] One such known source of error that is more commonly encountered in the COVID-19 intensive care unit (ICU) is the severe hypoxemia.

Widely there are two types of glucose strips available: glucose oxidase (GO) and glucose dehydrogenase (GDH) strips. In a GO strip, the enzyme GO interacts with the glucose in the blood and converts it into gluconic acid by accepting an electron. Now, this electron can be accepted either by oxygen and water to form hydrogen peroxide or by the specific oxidized mediator present in the strip which when accepts the electron passes it on to an electrode to generate a current that gets reported as glucose concentration. The mediator in the strip and the oxygen in the sample can both compete to take the electrons from the reduced GO, but the electrode in the glucometer will only pick up the mediator to show the glucose levels. If the oxygen in the sample is higher, the active mediator will be proportionally lower leading to underestimation of glucose; vice versa, if the oxygen in the sample is lower, it can lead to overestimation of the glucose level.[3] Blood glucose meters using the enzyme GO have been proven unreliable at high altitude for a similar reason. GDH blood glucose meters are likely to perform better than GO-based meters at high altitude as GDH is an oxygen-insensitive enzyme.[4]

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How to cite this article: Panda R, Hirolli D, Baidya DK. Point-of-care Glucose Monitoring in COVID-19 Intensive Care Unit: How's It Different? Indian J Crit Care Med 2021;25(12):1465–1466.
Source of support: Nil
Conflict of interest: None

Unlike GO strips, the readings of GDH strips are not altered by the oxygen level in the sample. GDHs are the oxidoreductases that are unable to utilize oxygen as electron acceptors. The electron acceptors for GDH are cofactors like nicotine adenine dinucleotide, nicotine adenine dinucleotide phosphate, flavin adenine dinucleotide, or pyrroloquinoline quinone. There are different subtypes based on the cofactors used. These cofactors then pass on the electrons to an oxidized mediator present in the strip which when accepts the electron passes it on to an electrode to generate a current that gets reported as glucose concentration.[5] The limitation of GO strips in giving an accurate glucose level value in varying oxygen concentrations can be overcome by the GDH glucose strips.

Thus, GDH strips should be preferred in measuring bedside blood sugar levels in COVID-19 ICU as most of the patients are hypoxemic and are likely to have a high glycemic variability.

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