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EDITORIAL

Towards continuous glucose monitoring in the ICU

¿Hacia una monitorización continua de glucosa en la UCI?

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After the two landmark Leuven studies,[1,2] glucose monitoring and control in the ICU were highlighted and opened an innovative research field that is here to stay. After those studies the target glucose control, tight or less stringent, and their related outcomes were not only a matter of cutting-edge investigations[3,4] but also forced a decisive move from glucose control from paper-based to computer-based algorithms and from intermittent to real-time continuous glucose monitoring (CGM) systems in order to better adjust insulin administration. Nearly at the same time research in the field moved towards additional improved clinical outcomes more specifically linked to the prevention of hyperglycemia, hypoglycemia and glycemic variability[5] and complexity.[6] In addition, requirements and recommendations to measure blood glucose and reporting glycemic control[7] and describing performance characteristics and suggested criteria related to ideal CGM systems have recently been published.[8]

Tight glucose control (TGC) benefit in the ICU is still a matter of intense debate but it has been associated with an increase in the rate of hypoglycemia episodes compared to a conventional glucose control.[9,10] The clinicians' and nurses' natural fear to iatrogenic hypoglycemia and the necessity to reduce glucose variability, independently of the chosen glucose target range, accelerated the development of computerized decision support systems and CGM devices to manage dysglycemia.

CGM systems sample intermittently and the frequency of actual glucose measurements and the immediate of the data display are the two factors that have to be considered when assessing them. The CGM systems are also able to identify and display trends in blood glucose measurements.[8] Wernerman et al. also summarized the different types of CGM devices as intravascular, transcutaneous and interstitial fluid glucose measuring devices with a sensor inserted subcutaneously.[8]

Subcutaneous CGM devices have been investigated in ICU patients receiving intensive insulin therapy to maintain normoglycemia (80–110 mg/dl) and have been shown to have good agreement between the values obtained by this method and those of arterial blood glucose measurements according to an algorithm and also significantly reduced hypoglycemic events.[11] In addition, good glucose measurement correlation has also been shown with arterial blood glucose in 234 pairs of subcutaneous sensor/blood glucose values in ICU patients in circulatory shock requiring norepinephrine therapy.[12] The point accuracy of one of these devices has also recently been shown to be relatively low in critically ill patients.[13]

In this issue, Ballesteros Ortega et al.[14] performed a study in 18 critically ill patients in distributive shock, admitted to their ICU between September 2010 and September 2011, to whom a subcutaneous CGM sensor was inserted in their abdominal wall and glucose values were recorded every 5 minutes. In five additional patients the sensor was unable to detect tissue glucose. Capillary glucose (CG) was also monitored, to adjust insulin perfusion, according to their ICU protocol aimed to maintain a range of blood glucose of the studied patients between 100 and 140 mg/dl. The authors obtained 11,673 CGM and 348 CG values which obviously imply that repeated observations were collected in every particular patient. They eventually compared 295 pairs of apparently simultaneous measurements obtained with both

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methods of glucose measurement, procured in the first 72 h after the placement of the subcutaneous CGM system sensor. Their main conclusion was that when the CGM device is able to obtain data there is correlation between the values obtained by both methods in patients with distributive shock. However, in the statistical analysis performed by the authors they did not consider the real nature of the obtained data: pairs of repeated CGM and CG measurements, with an average of 16 pairs per patient. This fact in our opinion eventually questions the reliability of the results.

While ultimate researches clarify the clinical advantages or disadvantages in addition to the cost-effectiveness of intravascular, transcutaneous or subcutaneous interstitial fluid CGM devices and validated closed loop systems for glucose control and eventually may be incorporated to our ICUs. In the meantime, let us optimize and update our routine blood glucose sample sites and analysis in addition to our currently used insulin administration algorithms to further improve the safety of our ICU patients and the quality of the given assistance.

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