Can this cool new glycaemia metric tell me if my critical care patients are going to live or die?

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Objective:

Stress-induced hyperglycaemia may negatively impact outcomes in critically ill patients. Continuous glucose monitoring (CGM) devices measure blood glucose (BG) every 5 minutes and enable analysis of high frequency dynamics like glucose complexity. Two recent studies in critically ill patients used Detrended Fluctuation Analysis (DFA) to quantify glucose complexity and concluded increased complexity, indicating a more normal, healthy regulatory response, was associated with reduced mortality.

Method:

CGM data from 10 patients in the Christchurch Hospital ICU with 3 CGM devices per-patient: 1 Medtronic Guardian Real-Time monitor in the abdomen; and 2 Medtronic iPro2 recorders located in the abdomen and the thigh, enabling inter-site and inter-device comparisons. Glucose complexity was quantified using DFA. For a self-similar time series, the scale invariant structure can be described by $X(ct) = c^H X(t)$. The power law exponent, H, was used as the basis for comparison, where a lower value indicates greater complexity.

Results:

Retrospectively calibrated iPro2 CGMs reported significantly higher scaling exponents: H = 1.56 [1.46 – 1.60] compared to Guardian Real-Time devices: H = 1.43 [1.37 - 1.48] ($p = 0.03$). Scaling exponents of patients who lived were H = 1.51[1.46 – 1.57] versus H = 1.47[1.39 – 1.59] for patients who died ($p = 0.5$). Using prior study results to segregate mortality showed that none of the ~~8~~ patients in this study had all 3 CGM devices indicating a single, or correct, outcome.

Conclusion:

These results show a much stronger association between glucose complexity and sensor/device type ~~are far more strongly associated~~ than glucose complexity and patient outcome, ~~where~~ which was an outcome of prior studies ~~used~~ using mixed device types. Further investigations of glucose complexity are required before solid conclusions can be drawn.