Blood glucose control and monitoring in the critically ill

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Chapter 4

Choosing the Correct metrics for glucose control

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In an attempt to determine whether strict glucose control (SGC) [1] was adopted in ICUs in Australia and New Zealand (ANZ) before or after the publication of NICE-SUGAR (Normoglycemia in Intensive Care Evaluation and Surviving Using Glucose Algorithm Regulation) [2], Kaukonen and colleagues examined the ‘mean of the highest and lowest blood glucose level in the first 24 hours after ICU admission’ (Glu₁) [3]. Assuming that a median Glu₁ of less than 6.44 mmol/L is an indicator of adoption of SGC, they conclude that SGC was not adopted before NICE-SUGAR and that this trial led to an even looser glucose control in their continent.

As the Glu₁ is calculated from blood glucose values in the first 24 hours, this metric by definition will not reflect what happens beyond the first day of ICU admission. Second, ICU algorithms for glucose control will never affect the first blood glucose level, which usually is the highest value in the first ICU day. We calculated median Glu₁ before and after successful implementation of a SGC algorithm in a large cohort in The Netherlands [4]. Whereas important metrics of glucose control changed, median Glu₁ did not (Table 1). Notably, we found a much higher median Glu₁ compared with that of Kaukonen and colleagues.

Table 1. Metrics of glucose control before and after implementation of strict glucose control [4]

<table>
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<tr>
<th></th>
<th>1 year before implementation</th>
<th>2 years after implementation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glu₁, median [IQR]</td>
<td>7.7 [6.6 – 9.3]</td>
<td>7.7 [6.5 – 9.3]</td>
<td>0.96</td>
</tr>
<tr>
<td>Mean blood glucose level per patient of all measured blood glucose levels during ICU admission, median [IQR]</td>
<td>7.1 [6.4 – 8.1]</td>
<td>6.5 [5.9 – 7.7]</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Time to reach normoglycemia in hours, median [IQR]</td>
<td>14.3 [7.3 – 26.7]</td>
<td>9.8 [5.2 – 16.7]</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Reached normoglycemia, patients (%)</td>
<td>1044 (79)</td>
<td>1818 (84)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Abbreviations: Glu₁, mean of the highest and lowest blood glucose level in the first 24 hours after ICU admission; IQR, Interquartile range

Numerous metrics are suggested as quality indicators of glucose control [5]. Most metrics differ in their definitions and many are not precise, prohibiting their applicability and hence reproducibility and comparability of research results. Median Glu₁ is not a good indicator of SGC, because of the aforementioned points, and will consequently differ among research cohorts.

Competing Interests
R.T.M van Hooijdonk did consulting work for Medtronic Inc. (Minneapolis, MN, USA) and GlySure Ltd (Abingdon, UK) and received research support from Medtronic Inc. and OptiScan Biomedical (Hayward, CA, USA). P.E. Spronk declares that he has no disclosures to report. M.J. Schultz received consultant fees from Medtronic Inc., GlySure Ltd, Edwards Life Sciences (Irvine, CA, USA), and Roche Diagnostics (Basel, Switzerland) and financial support from Medtronic Inc. and OptiScan Biomedical; all fees and financial support were paid to the institution.

Authors’ Contributions
Study concept and design: R.T.M. van Hooijdonk, P.E. Spronk and M.J. Schultz
Chapter 4

Acquisition of data: R.T.M. van Hooijdonk, P.E. Spronk and M.J. Schultz
Analysis and interpretation of data: R.T.M. van Hooijdonk and M.J. Schultz
Drafting and critical revision of the manuscript: R.T.M. van Hooijdonk, P.E. Spronk and M.J. Schultz

References


