Accuracy of a subcutaneous continuous glucose monitoring system in critically ill patients

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Background

• Achieving adequate glycaemic control is important and challenging in critically ill patients
• Continuous glucose monitoring (CGM) devices could improve glycaemic control since they provide real-time data
• CGM is not routinely used in intensive care
• Accuracy and reliability of CGM devices vary considerably in previous studies

Aim

To investigate the accuracy and reliability of the FreeStyle Navigator I in critically ill patients.

Methods

• Data from a previously published RCT: efficacy of CGM compared with point-of-care measurements
• Reference test: arterial ABL Flex automated blood gas analyzer (BGA), Radiometer, Denmark
• CGM: FreeStyle Navigator I (Abbott Diabetes Care, Alameda, CA, USA)
• BGA values were paired with concomitant CGM values (within maximal 15 minutes)
• Study duration: maximum 5 days

Results

• 155 patients with 2840 paired measurements
  ▪ Apache IV predicted mortality: 0.31 [0.15-0.65]%
  ▪ 101 (65.2%) medical admissions
  ▪ 38 (24.5%) diabetes
• 27 [20-32] paired measurements per patient
• Mean CGM glucose: 7.2 ± 1.9 mmol/L
• Mean BGA glucose: 8.0 ± 2.1 mmol/L
• Median absolute difference: 1.0 [0.5-1.8] mmol/L
• In 71 (46%) patients median absolute relative difference (MARD) ≥14%

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<th>Table 1. MARD</th>
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<tr>
<td>MARD</td>
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<tr>
<td>MARD all measurements</td>
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<td>BGA ranges mg/dL (mmol/L)**</td>
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<td>≤40 mg/dL (2.2)</td>
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<td>41-70 (2.3-3.9)</td>
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<td>71-180 (4.0-9.9)</td>
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<td>&gt;180 (10)</td>
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* Number of paired measurements
**MARD values (BGA ranges) are significantly different \( p<0.001 \)

• Bland Altman
  ▪ mean bias: -0.82 mmol/L
  ▪ Upper limit of agreement: 2.24 mmol/L
  ▪ Lower limit of agreement: -3.88 mmol/L
• ISO 15197 (2013): 1458 (51%) measurements are meeting the ISO standard (95% of glucose within ± 15 mg/dL of BGA <100 mg/dL & within ± 15% of BGA ≥ 100 mg/dL)
• Reliability: in 114 (73%) patients the CGM measured at least 95% of the time

Conclusion

• The CGM showed an acceptable accuracy in a mixed ICU population according to the Clarke error grid analysis, but did not meet the ISO standards 2013
• MARD was higher in hypoglycaemic ranges and hyperglycaemic ranges
• The CGM was functioning reliably in 73% of the patients

References