

Professional Continuous Glucose Monitoring in Subjects with Type 1 Diabetes: Retrospective Hypoglycemia Detection

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Abstract

Background:

An important task in diabetes management is detection of hypoglycemia. Professional continuous glucose monitoring (CGM), which produces a glucose reading every 5 min, is a powerful tool for retrospective identification of unrecognized hypoglycemia. Unfortunately, CGM devices tend to be inaccurate, especially in the hypoglycemic range, which limits their applicability for hypoglycemia detection. The objective of this study was to develop an automated pattern recognition algorithm to detect hypoglycemic events in retrospective, professional CGM.

Method:

Continuous glucose monitoring and plasma glucose (PG) readings were obtained from 17 data sets of 10 type 1 diabetes patients undergoing insulin-induced hypoglycemia. The CGM readings were automatically classified into a hypoglycemic group and a nonhypoglycemic group on the basis of different features from CGM readings and insulin injection. The classification was evaluated by comparing the automated classification with PG using sample-based and event-based sensitivity and specificity measures.

Results:

With an event-based sensitivity of 100%, the algorithm produced only one false hypoglycemia detection. The sample-based sensitivity and specificity levels were 78% and 96%, respectively.

Conclusions:

The automated pattern recognition algorithm provides a new approach for detecting unrecognized hypoglycemic events in professional CGM data. The tool may assist physicians and diabetologists in conducting a more thorough evaluation of the diabetes patient's glycemic control and in initiating necessary measures for improving glycemic control.

J Diabetes Sci Technol 2013;7(1):135–143

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Abbreviations: (AUC) area under the curve, (BG) blood glucose, (CGM) continuous glucose monitoring, (FN) false negative, (FP) false positive, (IG) interstitial glucose, (PG) plasma glucose, (ROC) receiver operating characteristic, (SMBG) self-monitoring of blood glucose, (TN) true negative, (TP) true positive

Keywords: continuous glucose monitoring, diabetes, hypoglycemia, machine learning, retrospective

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