Journal of Diabetes Science and Technology
Volume 2, Issue 3, May 2008

SYMPOSIUM

Development of a Clinical Type 1 Diabetes Metabolic System Model and *in Silico* Simulation Tool

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Abstract

Objectives:
The goal of this study was to develop a system model of type 1 diabetes for the purpose of *in silico* simulation for the prediction of long-term glycemic control outcomes.

Methods:
The system model was created and identified on a physiological cohort of virtual type 1 diabetes patients ($n = 40$). Integral-based identification was used to develop ($n = 40$) insulin sensitivity profiles.

Results:
The $n = 40$ insulin sensitivity profiles provide a driving input for virtual patient trials using the models developed. The identified models have a median (90% range) absolute percentage error of 1.33% (0.08–7.20%). The median (90% range) absolute error was 0.12 mmol/liter (0.01–0.56 mmol/liter). The model and integral-based identification of S_I captured all patient dynamics with low error, which would lead to more physiological behavior simulation.

Conclusions:
A simulation tool incorporating $n = 40$ virtual patient data sets to predict long-term glycemic control outcomes from clinical interventions was developed based on a physiological type 1 diabetes metabolic system model. The overall goal is to utilize this model and insulin sensitivity profiles to develop and optimize self-monitoring blood glucose and multiple daily injection therapy.

J Diabetes Sci Technol 2008;2(3):424-435

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Abbreviations: (CGM) continuous glucose measurement, (CSII) continuous subcutaneous insulin infusion, (HGP) hepatic glucose production, (IDDM) insulin-dependent diabetes mellitus, (MDI) multiple daily injection, (SMBG) self-monitoring blood glucose, (TBGU) total body glucose uptake

Keywords: blood glucose, compartmental models, decision support, diabetes, hyperglycemia, insulin, simulation, subcutaneous injection

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