

## Analysis of Intravenous Glucose Tolerance Test Data Using Parametric and Nonparametric Modeling: Application to a Population at Risk for Diabetes

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### Abstract

#### **Background:**

Modeling studies of the insulin–glucose relationship have mainly utilized parametric models, most notably the minimal model (MM) of glucose disappearance. This article presents results from the comparative analysis of the parametric MM and a nonparametric Laguerre based Volterra Model (LVM) applied to the analysis of insulin modified (IM) intravenous glucose tolerance test (IVGTT) data from a clinical study of gestational diabetes mellitus (GDM).

#### **Methods:**

An IM IVGTT study was performed 8 to 10 weeks postpartum in 125 women who were diagnosed with GDM during their pregnancy [population at risk of developing diabetes (PRD)] and in 39 control women with normal pregnancies (control subjects). The measured plasma glucose and insulin from the IM IVGTT in each group were analyzed via a population analysis approach to estimate the insulin sensitivity parameter of the parametric MM. In the nonparametric LVM analysis, the glucose and insulin data were used to calculate the first-order kernel, from which a diagnostic scalar index representing the integrated effect of insulin on glucose was derived.

#### **Results:**

Both the parametric MM and nonparametric LVM describe the glucose concentration data in each group with good fidelity, with an improved measured versus predicted  $r^2$  value for the LVM of 0.99 versus 0.97 for the MM analysis in the PRD. However, application of the respective diagnostic indices of the two methods does result in a different classification of 20% of the individuals in the PRD.

#### **Conclusions:**

It was found that the data based nonparametric LVM revealed additional insights about the manner in which infused insulin affects blood glucose concentration.

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**Abbreviations:** (CNT) controls, (GDM) gestational diabetes mellitus, (IM) insulin modified, (IVGTT) intravenous glucose tolerance test, (LVM) Laguerre based Volterra model, (MM) minimal model, (PRD) population at risk of developing diabetes, (T2DM) type 2 diabetes mellitus

**Keywords:** diabetes risk, intravenous glucose tolerance test, minimal model, nonparametric volterra model

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