

A Minimal C-Peptide Sampling Method to Capture Peak and Total Prehepatic Insulin Secretion in Model-Based Experimental Insulin Sensitivity Studies

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Abstract

Aims and Background:

Model-based insulin sensitivity testing via the intravenous glucose tolerance test (IVGTT) or similar is clinically very intensive due to the need for frequent sampling to accurately capture the dynamics of insulin secretion and clearance. The goal of this study was to significantly reduce the number of samples required in intravenous glucose tolerance test protocols to accurately identify C-peptide and insulin secretion characteristics.

Methods:

Frequently sampled IVGTT data from 12 subjects [5 normal glucose-tolerant (NGT) and 7 type 2 diabetes mellitus (T2DM)] were analyzed to calculate insulin and C-peptide secretion using a well-accepted C-peptide model. Samples were reduced in a series of steps based on the critical IVGTT profile points required for the accurate estimation of C-peptide secretion. The full data set of 23 measurements was reduced to sets with six or four measurements. The peak secretion rate and total secreted C-peptide during 10 and 20 minutes postglucose input and during the total test time were calculated. Results were compared to those from the full data set using the Wilcoxon rank sum to assess any differences.

Results:

In each case, the calculated secretion metrics were largely unchanged, within expected assay variation, and not significantly different from results obtained using the full 23 measurement data set ($P < 0.05$).

Conclusions:

Peak and total C-peptide and insulin secretory characteristics can be estimated accurately in an IVGTT from as few as four systematically chosen samples, providing an opportunity to minimize sampling, cost, and burden.

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Abbreviations: (AUC) area under curve, (CV) coefficient of variation, (IVGTT) intravenous glucose tolerance test, (NGT) normal glucose-tolerant, (T2DM) type 2 diabetes mellitus

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