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Incorporating a Generic Model of Subcutaneous Insulin Absorption into the AIDA v4 Diabetes Simulator 3. Early Plasma Insulin Determinations

Eldon D. Lehmann, Ph.D., F.R.C.R.,[1,2] Cristina Tarín, Ph.D.,[3] Jorge Bondia, Ph.D.,[4] Edgar Teufel, Ph.D.,[4] and Tibor Deutsch, Ph.D.[5]

Abstract

Introduction:

AIDA is an interactive educational diabetes simulator that has been available without charge via the Internet for over 12 years. Recent articles have described the incorporation of a novel generic model of insulin absorption into AIDA as a way of enhancing its capabilities. The basic model components to be integrated have been overviewed, with the aim being to provide simulations of regimens utilizing insulin analogues, as well as insulin doses greater than 40 IU (the current upper limit within the latest release of AIDA [v4.3a]). Some preliminary calculated insulin absorption results have also recently been described.

Methods:

This article presents the first simulated plasma insulin profiles from the integration of the generic subcutaneous insulin absorption model, and the currently implemented model in AIDA for insulin disposition. Insulin absorption has been described by the physiologically based model of Tarín and colleagues. A single compartment modeling approach has been used to specify how absorbed insulin is distributed in, and eliminated from, the human body. To enable a numerical solution of the absorption model, a spherical subcutaneous depot for the injected insulin dose has been assumed and spatially discretized into shell compartments with homogeneous concentrations, having as its center the injection site. The number of these compartments will depend on the dose and type of insulin. Insulin inflow arises as the sum of contributions to the different shells. For this report the first bench testing of plasma insulin determinations has been done.

Results:

Simulated plasma insulin profiles are provided for currently available insulin preparations, including a rapidly acting insulin analogue (e.g., lispro/Humalog or aspart/Novolog), a short-acting (regular) insulin preparation (e.g., Actrapid), intermediate-acting insulins (both Semilente and neutral protamine Hagedorn types), and a very long-acting insulin analogue (e.g., glargine/Lantus), as well as for insulin doses up to 50 IU.

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Author Affiliations: [1]Department of Imaging (MRU), Imperial College of Science, Technology and Medicine (NHLI), Royal Brompton Hospital, London, United Kingdom; [2]Department of Imaging, University of Toronto, Ontario, Canada; [3]Instituto de Telecomunicaciones y Aplicaciones Multimedia, Universidad Politécnica de Valencia, Valencia, Spain; [4]Instituto Universitario de Automática e Informática Industrial, Universidad Politécnica de Valencia, Valencia, Spain; and [5]Department of Informatics and Medical Technology, Faculty of Health Sciences, Semmelweis University, Budapest, Hungary

Abbreviations: (CSII) continuous subcutaneous insulin infusion, (I_{ex}) exogenous insulin flow profile, (I_p) plasma insulin, (IU) international units [of insulin], (NPH) neutral protamine Hagedorn

Keywords: absorption, computer, diabetes, insulin, model, simulation, software

Corresponding Author: Dr. Eldon D. Lehmann, Ph.D., F.R.C.R., c/o AIDA Diabetes Simulator Development Team, P.O. Box 38265, London NW3 7XZ, United Kingdom; email address correspondence@2aida.org

Abstract cont.

Discussion:

The methodology to be adopted for implementing the generic absorption model within AIDA has been overviewed, and the first plasma insulin profiles based on this approach have been demonstrated. Ideas for future work and development are discussed. It is expected that an updated release of AIDA (v4.5), based on this collaborative approach, will become available for free—in due course—via the *www.2aida.org* Web site. Readers who wish to be informed when the new software is launched can join the very low volume AIDA announcement list by sending a blank email note to *subscribe@2aida.org*.

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