Advantage of predictive modeling in tracer studies

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TO THE EDITOR: Sorensen et al. (1) compare the production rate of triglyceride, as calculated from a bolus injection decay curve, to that obtained from a primed constant infusion curve of the specific activity of radiolabeled tracer. They note a difference in the two rates and choose the constant infusion as the more accurate method. But is it? The bi-exponential model is a predictive model and uses measurements of the disappearance of tracer from the plasma compartment, over a limited period of time, to predict the plasma concentration of tracer for all time. The integral of this function over all time is the specific activity of the injected dose, which is used to calculate the production rate. On the other hand, the steady-state infusion model relies on measurement of the appearance of tracer in the plasma and therefore is only appropriate once the bi-directional flux of tracer between compartments has reached a steady state. At equilibrium, the primed constant infusion method will give the same production rate as the bolus. That it is different suggests that the time course is long enough to fit a bi-exponential decay curve but not long enough to establish steady state. In the bolus experiment, if tracer loss from the fast compartment is very rapid, its effect is negligible by the end of the experiment, which allows a second, slower decay curve to be detected. But in constant infusion, tracer that is fast to leave but slow to return will make the specific activity of the injected dose appear artificially low until equilibrium is reached. This is the power of the exponential function when used in this context: if the decay data fit a bi-exponential model, then all future information about the transfer of tracer between compartments will be described by the shape of the predicted curves. This two-pool model was introduced in these pages by Sapirstein et al. (2) as a simplified method to avoid possible errors in estimation attendant upon constant infusion methods. The specific activity of the rapid pool, as calculated from Sørensen, et al. solution of the bi-exponential model, is 22% of the total specific activity; if this missing amount is added to the measured specific activity in the constant infusion experiment, then the calculated production rates are the same. The more accurate number is derived from the bi-exponential equation, not the steady-state experiment, and, as the authors correctly conclude, is a strong indicator of rapid recycling of VLDL-TG through the periphery.

DISCLOSURES

No conflicts of interest are reported by the author.

REFERENCES


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