Modeling the drug response

Ursula M, Elisabeth Gundert-Remy, MD, PhD
Department of Clinical Pharmacology, University of Göttingen, Germany

The understanding of the effects of a drug is enhanced by the knowledge of the different steps in the chain of the events from the administration of the drug to the global effect which can be observed in the patient.

Thanks to Clinical Pharmacology the idea of changing concentrations with time, present at the relevant site of action(pharmacokinetics) was introduced into the concepts of the interplay between the concentration and the effect. The relationship between the concentration at the site of action and the pharmacodynamics have been characterized by pharmacodynamic models, of which the E_{max}-model is the mostly used, but not the only one. In some cases a so-called link model was used that serves to account for the delay of the pharmacodynamic effect relative to the plasma concentration.

Alternative more physiologically based models have been proposed which may be rather used as they contain explanatory information on the mechanisms underlying the drug's effect.

The power of the PKPD modeling is strongly enhanced when implementing the population approach which allows for the estimation of the population parameters and for the exploratory analysis of influential factors.

Examples of the PKPD-modeling of the drug response of several classes of drugs are presented (analgesics, benzodiazepines, beta-2-agonistic drug, antihypertensive drug).