Universität Basel

Research Project

The THY-MOD Study - Personalized Dosing in Children with Hyper- or Hypothyroidism Computed by Mathematical Modeling

Third-party funded project

Project title The THY-MOD Study - Personalized Dosing in Children with Hyper- or Hypothyroidism Computed by Mathematical Modeling

Principal Investigator(s) Koch, Gilbert ;

Co-Investigator(s) Szinnai, Gabor ; Pfister, Marc ;

Organisation / Research unit

Bereich Kinder- und Jugendheilkunde (Klinik)

Department

Project start 01.06.2019

Probable end 30.11.2021

Status Completed

Thyroid hormones are essential for normal brain development in the foetus and the infant, and for normal cognitive functions, normal growth and puberty in children and adolescents. However, treatment of thyroid diseases (congenital and acquired hyper- or hypothyroidism) is difficult in neonate, infants and children. First, a carefully selected initial dose based on clinical experience is necessary. Second, after reaching a physiological balance of thyroid hormones, a continuous adjustment of the individual dose depending on age and severity of thyroid disease is required to maintain euthyroidism during childhood and adolescence. To mitigate the risk of negative neurological and developmental outcome such as cognitive impairment, it is essential to establish an optimal, personalized dosing strategy that is continuously fine-tuned to account for specific needs in neonates, infants and children with hyper- or hypothyroidism. Dynamical mathematical models based on population pharmacokinetic / pharmacodynamic (PKPD) principles with individual covariate effects together with algorithms from optimal control theory will be developed and applied to retrospective longitudinal disease measurements from 5 Swiss paediatric hospitals. Developed models and algorithms will be validated based on prospective collected data in a large international paediatric thyroid centre. This will allow the prediction of an optimal personalized dosing strategy that maintains thyroid hormones in the normal reference range. Models and algorithms to compute optimal personalized dosing in neonates, infants and children are a medical necessity to optimize long-term neurological outcome and consequently enhance performance in school and professional education, and to increase life quality of paediatric patients and their parents.

Financed by

Swiss National Science Foundation (SNSF)