Linear regression model of final height prediction based on pre-treatment data in children with growth hormone (GH) deficiency treated with GH

Maciej Hilczer [1,2], Joanna Smyczyńska [1], Urszula Smyczyńska [3], Renata Stawerska [1], Andrzej Lewiński [1,4]

[1] Polish Mother's Memorial Hospital – Research Institute, Department of Endocrinology and Metabolic Diseases, Lodz, Poland
[2] Medical University of Lodz, Department of Pediatric Endocrinology , Lodz, Poland
[3] AGH University of Science and Technology; Department of Automatics and Biomedical Engineering, Cracow , Poland
[4] Medical University of Lodz, Department of Endocrinology and Metabolic Diseases , Lodz , Poland

Disclousure statment: nothing to disclose

Introduction

Prediction of growth hormone (GH) therapy effectiveness in children with short stature is an important issue in paediatric endocrinology. The leading method for prediction of growth hormone (GH) therapy effectiveness are **multiple linear regression (MLR) models**. The need for creating and improving the models of growth response to GH therapy has been strongly recommended [1]. Only few models were dedicated for prediction of the attained final height (FH) [2, 3].

Objectives

The aim of the study was to create a linear regression model of GH therapy effectiveness in children with isolated GH deficiency, based on the data available before treatment.

Methods

Retrospective analysis comprised the data of 150 short children (101 boys), diagnosed with isolated GH deficiency, who were treated with GH for at least 2 years, up to the attainment of FH.

The following parameters (input variables) were assessed before treatment for each patient:

- **gender**
- chronological age (**CA**)
- bone age delay (**BA/CA** ratio)
- height (as **hSDS**)
- mothers' and father's height (as **hmSDS** and **hfSDS**)
- height velocity (**HV**)
- birth weight (as **bwSDS** for gestational age)
- pubertal stage (**pub st**, labelled: prepubertal - 0, pubertal - 1)
- **GH peak after falling asleep**
- **GH peak in 2 stimulation tests**
- IGF-I (as **IGF-I SDS** for age and sex)
- **IGF-I/IGFBP-3** molar ratio

The output variable was: **final height** (expressed as **FH SDS**)

Results

The procedure of backward stepwise regression resulted in following model:

$$FHSDS = 0.683 + 0.529 \cdot hSDS - 0.286 \cdot IGF\text{–}I\ SDS - 0.152 \cdot HV + 0.146 \cdot hmSDS + 0.163 \cdot hfSDS$$

The root mean square error (**RMSE**) of predicted FH SDS was **0.59 SD (3.5 cm)** for learning group and **0.63 SD (3.8 cm)** for testing group. The model explained **44% of variability** of FH SDS in learning group and **36%** in testing group.

Statistically insignificant variables were removed in the following order:

gender → GH peak in tests → GH peak after falling asleep → bwSDS → IGF-I/IGFBP-3 → BA/CA → pub st → CA

Conclusions

Auxological indices and **IGF-I secretion before treatment** **but not** **GH peak after failing asleep** and **GH peak in stimulation tests** **were significant predictors of GH therapy effectiveness** in children with isolated GH deficiency. Relatively high amount of variability of FH SDS remains unexplained by the model, probably in part due to nonlinear dependencies between variables.

References:

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Maciej Hilczer
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