



The influence of growth hormone treatment on carbohydrate metabolism in children born small for gestational age.

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Background

Children born small for gestational age (SGA) or with intrauterine growth retardation (IUGR) have increased risk of metabolic disorders such as insulin resistance, diabetes mellitus type 2 or coronary disease in adulthood. After a catch-up period, most of those children achieve the same height as their peers. However, 10 % of them are short as adults. In some countries, there is a possibility of treatment with recombinant human growth hormone (rhGH) in patients with SGA/IUGR, in Poland since 2015. The interesting issue is whether the rhGH treatment gives patients not only auxological, but also metabolic advantages.

Aim of study

The aim of the study was to analyze carbohydrate metabolism parameters in children before and in the course of growth hormone treatment.

Material and methods

We analyzed the medical records of 41 SGA patients with normal GH secretion and 45 patients with growth hormone deficiency (GHD) as a control group. In both groups data were analyzed at baseline and after 12 months of rhGH treatment. We used the following anthropometric and biochemical parameters: height, height SDS, bone age, fasting glucose, fasting insulin, HbA1c levels and HOMA-IR, QUICKI indexes. In the SGA group we also analyzed glucose and insulin levels in the oral glucose tolerance test (OGTT) performed at baseline and after 12 months of rhGH treatment. We made calculations using Statistica. We used the T-student test, the Wilcoxon test and the U-Mann-Whitney test as appropriate.

Results

Baseline characteristics of both groups are presented in Table 1. We found significant differences in fasting insulin and HOMA-IR between both groups (SGA/IUGR vs GHD) before growth hormone treatment.

After one year of treatment in the SGA/IUGR patients there were statistically significant differences in glucose level in 120 min OGTT ($p < 0.001$), fasting insulin ($p = 0.03$), insulin level in 120 min OGTT ($p < 0.001$), HOMA-IR ($p < 0.05$) and HbA1c ($p < 0.05$) (Table 2).

After one year of treatment we did not find any statistically significant differences between SGA/IUGR and GHD patients in carbohydrate or auxological parameters (Table 3). In the SGA/IUGR group, 3 patients fulfilled the criteria of impaired glucose tolerance (IGT). In the GHD group, 4 patients fulfilled the criteria of impaired fasting glucose (IFG) and 1 patient fulfilled the criteria of IGT.**

**Changes in relation to the data from the abstract result from the expansion of the research group.

Conclusions

Statistically significant greater levels of carbohydrate parameters during GH therapy may suggest that in these patients, growth promoting therapy does not provide parallel metabolic benefits. Those changes are not statistically different between patients treated with rhGH due to SGA/IUGR or GHD.

Table 1. Data at baseline of treatment with rhGH in SGA/IUGR patients and children with GHD.

	Baseline		p value
	SGA/IUGR	GHD	
Number of patients	41	45	
Age (years)	9.5 (7.25-11.92)	10.49 ± 3.31	0.26
Height age (years)	6.83 (5.16-9.5)	7.81 ± 2.89	0.37
Bone age (years)	8.0 (6-11)	8.4 ± 3.4	0.68
Height (cm)	126 ± 16.81	127.7 ± 17.79	0.65
Height SDS	-2.3 [(-2.50)-(-2.1)]	-2.4 [(-2.8)-(-2.1)]	0.24
HV (cm/year)	5.6 ± 1.07	5.28 ± 1.35	0.22
IGF-1 (ng/ml)	136 (84.4-200)	119 (76.8-206)	0.60
Fasting glucose (mg/dl)	81.87 ± 6.46	82.78 ± 8.82	0.59
Fasting insulin (μU/ml)	3.71 (2.2-7.26)	2.48 (2.00-4.31)	0.02
HOMA-IR	0.7 (0.45-1.54)	0.52 (0.39-0.88)	<0.05
QUICKI	0.41 (0.36-0.44)	0.43 (0.39-0.45)	0.05
HbA1c (%)	5.3 (5.1-5.5)	5.19 ± 0.31	0.37

*minute of OGTT

Table 2. Data at baseline and after 1 year of treatment with rhGH in patients with SGA/IUGR.

	Baseline	After 12 months of rhGH	p value
Number of patients	41	29	
Age (years)	9.5 (7.25-11.92)	11.05 ± 2.98	
Height age (years)	6.83 (5.16-9.5)	8.88 ± 2.74	<0.001
Bone age (years)	8.0 (6-11)	9.88 ± 3.28	<0.001
Height (cm)	126 ± 16.81	134.58 ± 16.40	0.04
Height SDS	-2.3 [(-2.50)-(-2.1)]	-1.9 ± 0.41	<0.001
GV (cm/year)	5.6 ± 1.07	8.4 ± 1.63	<0.001
IGF-1 (ng/ml)	136 (84.4-200)	263 (167-361)	<0.001
Fasting glucose (mg/dl)	81.87 ± 6.46	82.39 ± 6.08	0.74
Glucose 60* (mg/dl)	107.40 ± 27.41	113 (99-127)	0.26
Glucose 120* (mg/dl)	90.97 ± 16.58	99 (92-114)	<0.01
Fasting insulin (μU/ml)	3.71 (2.20-7.26)	5.07 (2.43-9.18)	0.03
Insulin 60* (μU/ml)	34.6 (17.2-59.1)	42.60 (30.00-78.80)	0.05
Insulin 120* (μU/ml)	21.3 (9.65-36.9)	41.80 (23.7-58.6)	<0.001
HOMA-IR	0.7 (0.45-1.54)	1.07 (0.46-1.93)	<0.05
QUICKI	0.41 (0.36-0.44)	0.38 ± 0.05	0.05
HbA1c (%)	5.3 (5.1-5.5)	5.17 ± 0.30	<0.05

*minute of OGTT

Table 3. Data after 1 year of treatment with rhGH in SGA/IUGR patients and patients with GHD.

	After 12 months of rhGH treatment		p value
	SGA/IUGR	GHD	
Number of patients	29	44	
Age (years)	11.05 ± 2.98	11.39 ± 3.28	0.66
Height age (years)	8.88 ± 2.74	9.20 ± 2.99	0.65
Bone age (years)	9.88 ± 3.28	10.75 (7.25-12.62)	0.96
Height (cm)	134.58 ± 16.40	136.26 ± 17.98	0.69
Height SDS	-1.9 ± 0.41	-1.94 ± 0.63	0.76
GV (cm/year)	8.4 ± 1.63	9.11 ± 1.58	0.75
Height SDS changes after 1 year	0.7 (0.5-1.8)	0.7 (0.3-0.9)	0.06
IGF-1 (ng/ml)	263 (167-361)	259.71 ± 133.8	0.52
Fasting glucose (mg/dl)	82.39 ± 6.08	86 (78-90)	0.08
Glucose 60* (mg/dl)	113 (99-127)	126.5 ± 31.79	0.43
Glucose 120* (mg/dl)	99 (92-114)	101 (90-113)	0.86
Fasting insulin (μU/ml)	5.07 (2.43-9.18)	8.30 (2.52-11.45)	0.26
Insulin 60* (μU/ml)	42.60 (30.00-78.80)	51.95 (38.60-92.10)	0.33
Insulin 120* (μU/ml)	41.80 (23.7-58.6)	41.45 (24.30-70.20)	0.84
HOMA-IR	1.07 (0.46-1.93)	1.84 (0.53-2.40)	0.35
QUICKI	0.38 ± 0.05	0.35 (0.33-0.43)	0.26
HbA1c (%)	5.17 ± 0.30	5.25 ± 0.30	0.26

*minute of OGTT

