CLINICAL STUDY

Pituitary size in patients with Laron syndrome (primary GH insensitivity)

Liora Kornreich, Gadi Horev, Michael Schwarz, Boaz Karmazyn and Zvi Laron¹*Imaging Department and ¹Diabetes Research and Endocrinology Unit, Schneider Children's Medical Centre of Israel, Petah Tiqva, Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel**(Correspondence should be addressed to L. Kornreich; Email: korn@netvision.net.il)*

Abstract

Objective: The purpose of the present study was to investigate whether lifelong secretion of high levels of GH, characteristic of Laron syndrome, leads to an increase in the size of the pituitary gland.

Methods: Eleven patients (six females, five males) with Laron syndrome underwent magnetic resonance imaging of the pituitary region with a system operating at 0.5 T. There were nine adults aged 36–68 years and two children, a 4-year-old boy and a 9-year-old girl. The latter patient had been treated with IGF-I (150–180 mg/kg per day) since the age of 3 years; all the other patients were untreated. The height of the adenohypophysis was measured on the sagittal images and compared with reference values for age and sex.

Results: The height of the adenohypophysis was within the normal range for age and gender in all patients, except for one male, who had a small gland. No congenital anomalies of the pituitary–hypothalamic region were detected.

Conclusion: Despite the lifelong high levels of GH, no pituitary hypertrophy was detected. The anatomy of the pituitary–hypothalamic region in Laron syndrome is normal.

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Introduction

Laron syndrome (LS) is characterized by primary growth hormone (GH) insensitivity or resistance which is caused by deletions or mutations in the GH receptor gene or post-receptor pathways (1–3). These defects lead to an inability to generate insulin-like growth factor-I (IGF-I) (4) and, by negative feedback, to the secretion of high amounts of GH by the pituitary (5), reaching levels observed in acromegaly (6). On the basis of the observation by Nagel *et al.* (7) that pituitary size is correlated with GH secretion, and data collected in our long-term follow-up of patients with LS attending our clinic (8), we sought to determine if the lifelong oversecretion of GH causes enlargement of the pituitary gland and sella.

Subjects and methods

Subjects

The study included 11 patients (six females, five males) with LS. The diagnosis was based on the presence of severe short stature and features of GH deficiency, combined with a high basal level of GH and a low serum

level of IGF-I unresponsive to exogenous GH administration. There were nine adults, aged 36–68 years, and two children, a 4-year-old boy and a 9-year-old girl. The latter patient had been treated with IGF-I (150–180 mg/kg per day) since the age of 3 years; all the other patients were untreated.

Methods

All the patients underwent magnetic resonance imaging (MRI) of the brain with a system operating at 0.5 T. The imaging protocol included coronal and sagittal T1-weighted images of the pituitary and axial Fast Spin Echo and T1-weighted images of the brain. The maximal craniocaudal height of the adenohypophysis was measured at the site of stalk insertion and taken as the indicator of size. Reference values for normal adenohypophysial height according to age and gender were derived from a large study by Tsunoda *et al.* (9), and for children, from the study of Argyropoulou *et al.* (10). The shape of the upper surface of the gland (concave, flat or convex) and the presence of the bright spot of the neurohypophysis and of the stalk were noted. Contrast agent was not injected.

Table 1 Pituitary size and shape in patients with Laron syndrome.

Patient no.	Age (years)/sex	Pituitary shape	Pituitary height (mm)	Normal values of pituitary height (mm)
1	4/M	Concave	3	2–6
2	36/M	Flat	5	5.40±1.06
3	41/M	Flat	2	4.89±0.89
4	46/M	Concave	4	4.89±0.87
5	68/M	Concave	6	4.78±1.02
6	39/F	Flat	4	5.68±1.10
7	42/F	Concave	4	5.19±1.13
8	43/F	Flat	4	5.19±1.13
9	44/F	Concave	5	5.19±1.13
10	48/F	Flat	5	5.19±1.13
11*	9/F	Flat	5	2–6

* IGF-I-treated.

Results

The anatomy of the hypothalamic–pituitary region was normal in all patients. The main findings are summarized in Table 1. With the exception of one patient (no. 3), who had a small pituitary gland, the size of the pituitary gland was within the normal range for age and gender in all adult patients, males and females. This was also true for the 4-year-old untreated boy, as well as the 9-year-old IGF-I-treated girl. The shape was either flat or concave, and the contour symmetrical. There were no signs of hypertrophy, and adenomas were not detected.

Discussion

The somatotroph cells that secrete GH make up about 50% of the hormone-producing cells of the anterior pituitary (11). Nagel *et al.* (7) studying 91 children came to the conclusion that pituitary size reflects GH secretion. We suspected that lifelong oversecretion of GH (6, 8) could result in somatotroph hyperplasia and be detected by MRI as an enlargement of the pituitary gland. However, MRI of nine adult patients with LS showed a pituitary size within normal limits.

Enlargement of the pituitary was described in patients with ectopic GH-releasing tumours (12) and in GH-secreting pituitary adenomas (13). By contrast, the high levels of GH in LS do not affect pituitary size.

One explanation of our findings may be that patients with LS indeed secrete more GH than normal (6), but in a pulsatile manner which is insufficient to produce pituitary hyperplasia. This is in contrast to patients with tumours secreting GH-releasing hormone, causing acromegaly, in whom GH secretion is constantly high. Another possibility is that the mechanism underlying the enlargement and multiplication of the somatotrophs needed for volume enlargement is GH-driven, and IGF-I-dependent and therefore impossible in the GH-insensitive state of LS.

The anatomy of the hypothalamic–pituitary region was normal despite various developmental abnormalities in the skull and base of the skull found in the same patients (14).

To the best of our knowledge, this is the first controlled study of the hypothalamic–pituitary region in patients with GH insensitivity (LS).

In conclusion, LS is a unique abnormality of the GH axis, characterized by high serum levels of GH. Despite the lifelong oversecretion of GH, there is no pituitary hypertrophy.

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