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The use of somatotropin and myopia

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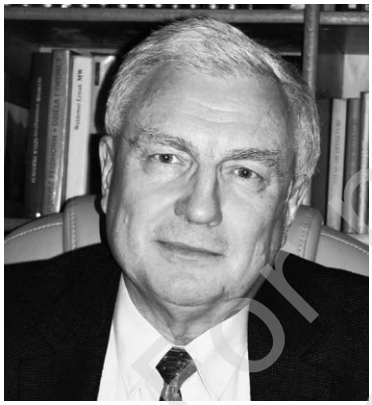

HIGHLIGHTS

Children treated with somatotropin should be periodically examined ophthalmologically for the onset or progression of myopia and early treatment should be started with them.

ABSTRACT

Aim of the study: Long-term observation of changes of the eye axial length and refraction in children treated with growth hormone.

Material and methods: The studies were performed in 11 children treated with somatropin, who had eye examinations performed annually, including measurements of the eye axial length and refraction. The observation period was 5–9 years.

Results: 55% of the observed children showed an excessively increase in the axial eye length and the development or progression of pre-existing myopia.

Conclusion: The use of somatropin in children may cause excessive elongation of the eye axial length and the development or progression of pre-existing myopia.

Key words: somatotropin, myopia, eye axial length

INTRODUCTION

Somatotropin (growth hormone) is a polypeptide hormone produced by the acid cells of the anterior lobe of the pituitary gland. It is used in the deficiency of this hormone of pituitary origin in children and in growth disorders in the course of various diseases, for example Turner syndrome or Prader-Willi syndrome. Its long-term use can cause various side effects such as transient edema, sodium and water retention, pseudotumor of the brain, carpal tunnel syndrome, gynecomastia, pancreatitis, skin nevi, headaches and muscle pain, hyperglycemia and increased intracranial pressure [1, 2]. In the visual organ, optic nerve edema, proliferative retinopathy and increased intraocular pressure were observed in some treated children [3, 4]. In experimental studies in rats, a significant elongation of the axial length of the eyeballs was also observed [5]. Published clinical studies, however, have yielded conflicting results. Some of them found an unremarkable increase in axial eyeball length after growth hormone treatment [6]. In other papers, no such relationship was observed [3, 4]. A report published in 2020 by the American Academy of Ophthalmology concluded that growth hormone does not cause myopia in children without a previous refractive error but may increase myopia in patients with previous myopia, and therefore when visual problems are noticed, the child should be referred for an eye examination [7].

Due to this controversy, the purpose of this publication is to study the effect of long-term growth hormone therapy on changes in eye length and refraction in treated children.

MATERIAL AND METHODS

The study was carried out in 11 children aged 10 to 16 years treated with growth hormone, in whom ocular examinations, including refraction and axial eyeball length measurements, were performed at yearly intervals. The follow-up period ranged from 5 to 9 years. In all of them, in addition to routine eye examinations, the following were performed: measurements of the axial length of the eyeball using the A-Scan Plus Connect apparatus, (Accutome, USA) and refraction testing with the Retinomax 4 K plus apparatus (Righton, Japan). The obtained results of axial eyeball length measurements were compared with the results of previously performed axial eyeball length studies in a population of healthy children [8].

The significance of the obtained results was evaluated using the Mann-Whitney U test.

RESULTS

In the observed group of patients, the presence of myopia was found in 2 of them at the beginning of the observation period, ranging from -1.0 D to -2.0 D. In the remaining 9, no refractive error was found. During the observation period, 6 (55%) patients developed or progressed pre-existing myopia. The defect was found in 4 children who did not have myopia at the beginning of observation period while progression of the defect was found in all (two) patients with the previous refractive error. In the remaining 5 patients, the refractive error at the end of the observation period ranged from 0.0 D to -0.75 D (tab. 1).

In the group of somatotropin-treated children with prior myopia, the axial length of the eyeball increased by 2.1 mm to 3.3 mm during the follow-up period, while in the group of children with no prior refractive error it increased by 1.4 mm to 2.65 mm (tab. 2). In the 4 patients who did not have myopia, the eyeball length increased by 0.6 mm (tab. 2). The final eyeball lengths in children treated with somatotropin compared to the average eyeball length in the population of Polish children aged 10–16 years:

- differed very significantly statistically in the group of children with a previous refractive error
- differed significantly statistically in the group of children without previous myopia
- were non-significant in treated children without myopia (tab. 3).

TABLE 1

Refractive changes in children treated with growth hormone.

Group with myopia progression an no previous refractive error	Group with previous myopia (initial error in parentheses)	Group without myopia
-3.0 D -3.5 D -4.0 D -5.5 D	-5.0 D (-1.0 D) -8.0 D (-1.75 D) (after cataract surgery)	-0.25 D 0.0 D -0.5 D 0.0 D -0.75 D

The table shows the average of the results from both eyes.

TABLE 2

Changes of axial eyeball length during somatotropin treatment (in mm).

Somatotropin treated children		
Children with previous myopia	**Children without a previous defect who have developed myopia**	**Children without myopia**
from 2.1 to 3.3	from 1.4 to 2.65	0.6

TABLE 3

Final axial eyeball lengths in children treated with somatotropin compared to the average axial eyeball length in the population of Polish children aged 10–16 years (in mm).

Somatotropin treated children			Healthy children [8]
Children with previous myopia	Children without a previous defect who have developed myopia	Children without myopia	
25.1*	24.3**	23.7[n]	22.34–22.96

* Statistical significance at $p < 0.001$ compared to healthy children.
** Statistical significance at $p < 0.01$ compared to healthy children.
[n] Not statistically significant compared to healthy children.

DISCUSSION

Results of the present study have shown that the use of somatotropin during the developmental period in children can cause excessive elongation of the axial length of the eyeball and the development or progression of pre-existing myopia. These changes were observed in about half of the treated children, while the refractive error itself increased by as much as -6.25 D over 9 years (this patient had also been operated on for cataracts in both eyes, which may have further influenced the progression of the myopia, known as myopic shift).

CONCLUSIONS

The prevalence of myopia in children in Poland ranges from 7.5% (rural environment) to 13.5% (urban environment) [9]. So, myopia is four times more common in children treated with somatotropin. These observations are corroborated by the results of experimental studies on rats, which showed excessive eyeball elongation after growth hormone administration [5].

The results of the present study indicate that children treated with somatotropin should be periodically examined ophthalmologically for the onset or progression of myopia and early treatment should be started to them (atropine drops, rigid gas permeable contact lenses, MiSight contact lenses, MiYoSmart eyeglasses).

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Conflict of interest:
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Ethics:
The content presented in the article complies with the principles of the Helsinki Declaration, EU directives and harmonized requirements for biomedical journals.