

GROWTH AND DEVELOPMENT OF CHILDREN WITH DIABETES MELLITUS

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Key-words: *Diabetes mellitus - growth - physical development - growth retardation - children*

Growth and development of children with insulin-dependent diabetes mellitus reflect to a great extent the severity of the disease and the effectiveness of treatment. Normal parameters of height and body mass are considered an additional criterion in the evaluation of disease control. Results from investigations of different authors are contradictory and show that growth in height is normal in diabetic children [5] or delayed in them [4,7] while body mass is enhanced or reduced than corresponding age norms. Most authors establish a certain delay of sexual development in these children.

The aim of the present work was to study diabetes mellitus reflections on both growth and development of children with this disease.

MATERIAL AND METHODS

Both growth and body mass of a total of 255 diabetes mellitus children (123 boys and 132 girls) aged between 3 and 18 years were examined. Duration of disease was between 2 and 16 years. Menarche age was recorded in 38 girls. Of all children, 172 live in cities and towns but 83 ones in villages predominantly in North-Eastern Bulgaria. Both parameters were presented graphically on curves reflecting corresponding age norms of healthy children's population in Bulgaria in order to obtain a pictorial idea about the height and body mass of diabetics in various age periods [2]. In the course of statistical data processing the alternative analysis (comparison of parameters of relative share by using of t-criterion at a corresponding significance level of $p = 0,05$) was applied.

RESULTS AND DISCUSSION

A. HEIGHT

Most points (89,9 per cent) reflecting diabetics' height at the moment of measurement are located in the zone of healthy children (between -2 and $+2$ σ -deviations). Height is lower than the normal limit in 10 girls (7,57 per cent) and in 16 boys (13 per cent) only. A total of 10,2 per cent of children with diabetes mellitus show growth retardation. Thus this parameter is significantly higher than that for the general population (by about 2,5 per cent) [2].

On the figures presented it can be seen that growth retardation is mainly manifested during puberty in both boys and girls. In the age group before 11 years there is a retardation in 1,5 per cent of the girls while after this age it is established in 6,1 per cent of them (fig. 1). There is a retardation before the age of 13 years in 3 per cent of the boys and after this age in 9,1 per cent of them ($p < 0,05$) (fig. 2).

B. BODY MASS

Body mass of 244 diabetic children (95,7 per cent) is within normal limits for the corresponding age. It is over the norm in 4 girls (3 per cent) and in one boy (0,8 per cent) but below the norm in 2 girls (1,5 per cent) and in 4 boys (3,2 per cent) only. These parameters do not indicate any statistically significant differences in comparison with the healthy population.

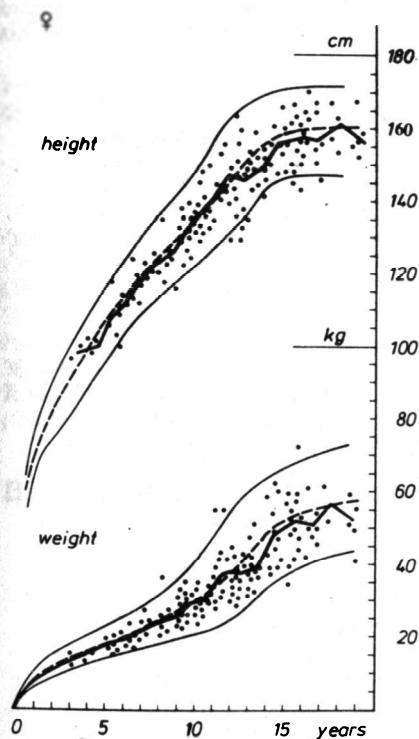


Fig. 1. Height and weight of 132 girls with diabetes mellitus

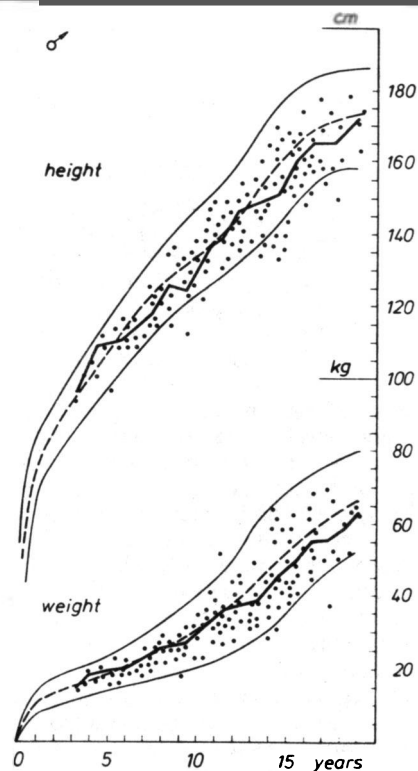


Fig. 2. Height and weight of 123 boys with diabetes mellitus

C. SEXUAL DEVELOPMENT

Pubertal development of children can be evaluated by means of age of menarche in 38 diabetic girls. Mean age obtained, i.e. 13 years and 2 months, is by 9 months later than that in the health population being 12 years and 3 months [1].

D. FACTORS RESPONSIBLE FOR GROWTH RETARDATION OF DIABETIC CHILDREN

In order to clarify the reasons for growth retardation in diabetes mellitus some data related to 26 children with proved retardation are examined and analyzed.

1. Sex. According to our results, boys grow more slowly (in 13 per cent) than girls (in 7,6 per cent) ($p < 0.05$). However, this difference of incidence rate cannot be adequately explained yet.

2. Place of residence. Growth disturbances are observed almost equally frequently among diabetic children living in cities and towns (in 9,9 per cent) and in villages (in 10,8 per cent).

3. Age of onset of disease. Results presented on fig. 3 demonstrate that growth disorders affect extraordinarily only children which onset of disease is prior to puberty. Of a total of 26 diabetic children of low height, 24 ones are ill already before the 10th year of life. Mean duration of disease of these patients is 6,19 years.

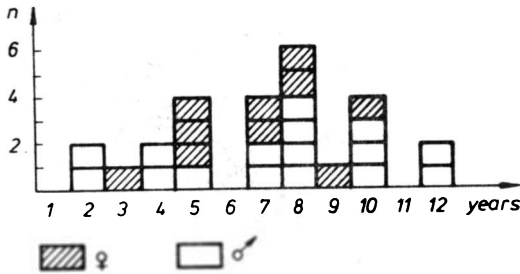


Fig. 3. Distribution of growth-retarded diabetics according to sex and age at the onset of disease

4. Control. Nine children (34,6 per cent) of the aforementioned 26 ones with retardation of growth and development are chronically decompensated and need frequent hospitalizations (more than 4 ones). Other diabetic complications (such as polyneuropathy, lipodystrophiae, retinopathy) have been detected in 6 children (in 23 per cent of these cases).

5. Therapy. All children undergo insulin therapy. Of the whole group of 255 children, 38 ones (14,9 per cent) receive insulin once daily but 217 children (85,1 per cent) receive it in the form of two or more applications daily. There is a similar ratio (4 children or 15,4 per cent, to 22 ones, or 84,6 per cent, respectively) when diabetic children with growth retardation are concerned. It has to be noted that one insulin application daily has been used in the period before 1979. Statistically significant therapeutic differences in both groups are related to the application of monocomponent insulins - as a total, in 59,2 per cent of all diabetics and only in 11,5 per cent of children with growth disturbances as well as to the considerably more seldom application of these insulins which present combinations of rapidly acting and prolonged insulin preparations - in 11,5 per cent of children with retardation towards in 30,6 per cent of children of the whole group.

After insulin introduction in the therapy of diabetes mellitus and particularly after application of intensified therapeutic schedules one observes serious growth retardation much more seldom to the extent of elimination as in Mauriac's syndrome. Most diabetic children grow up to the adult age without any significant abnormalities of height parameters. No gender differences exist in this aspect. Our results demonstrate that some ill children's growth and development are unfavourably influenced by diabetes mellitus. Parallel retardation of growth and sexual development depends on the age at the onset of disease and it is manifested only in cases when diabetes has started prior to pubertal growth incitement. This conclusion confirms other authors' data [6,8] who find out that diabetic children tend to growth retardation more often than their coevals mainly in the age between 12 and 16 years as well as when diabetes has developed at least 3 years before puberty. Tattersal and Pyke [10] reveal in the course of their large study of twins that this one who becomes ill before puberty delays his growth. This difference persists in adult age, too, and accounts at the average of 7,5 cm in 7 twin pairs. The importance of growth retardation established by us increases when one compares it with children's height at the moment of originating of the diabetes mellitus. In our previous investigation we ascertain that mean height of children at the onset of the disease is even greater than mean height of the general population [3].

Insufficient nutrition due to dietary restrictions, inadequate insulin therapy and poor control are considered reasons for retardation of growth and development of children with diabetes [4,6,11]. Analysis of control and treatment of 255 diabetic children reveals obvious therapeutic differences between children with growth retardation and these of the general group. It enables us to accept that insufficient insulin therapy and poor control influence unfavourably upon the physical and sexual children's development. The fact that there are severe degrees of retardation below 3 σ -deviations of which 2 children with Mauriac's syndrome prior to the application of new intensified therapeutic schedules of diabetes argues for this assumption. Furthermore, our observations on 4 cases with retardation prove an acceleration of growth after therapy

intensification, i. e. after transition to a threefold application of monocomponent insulins. A similar constation is already reported by Wolf et al. [11].

As our investigation covers the childhood only and we do not possess examinations of the final height of adult diabetics we are not able to determine if there is a temporary growth retardation or a long-lasting influence upon final height.

REFERENCES

1. Дамянова, М., З. Станчев. *Ендокринология в детската възраст*. София, Медицина и физкултура, 1977. 230 с.- 2. Станчев, З., Ж. Желев. *Физиология и патология на растежа*. София, Медицина и физкултура, 1980. с. 65.- 3. Цанева, В. Канд. дис. Варна, ВМИ, 1986.- 4. Craig, J.O. *Postgrad. Med. J.*, 46, 1970 607-610.- 5. Jackson, R.L., et al. *Diabetes Care*, 1, 1978, 96-107.- 6. Jivani, S.K., P.H. Rainer. *Arch. Dis. Childh.*, 48, 1973, 109-115.- 7. Malone, J., et al. *Pediatrics*, 78, 1986, No 2, 298-304.- 8. Menin, M., J.F. Desjeux, H. Lestrade. *Arch. Fr. Pediatr.*, 38, 1981, 159-164.- 9. Salardi, S., et al. *Arch. Dis. Childh.*, 62, 1987, No 1, 57-62.- 10. Tattersal, R.B., D.A. Pyke. *Lancet*, 2, 1973, 1105-1105.- 11. Wolf, J., E. Wolf, P. Hurter. *Monatsschr. Kinderheilk.*, 135, 1987, No 11, 770-774.

ВЛИЯНИЕ САХАРНОГО ДИАБЕТА НА РОСТ И РАЗВИТИЕ ДЕТЕЙ

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РЕЗЮМЕ

Рост и развитие детей, болеющих инсулинозависимым сахарным диабетом, являются доказательством тяжести заболевания и необходимости в эффективном лечении. Прослеживались рост и вес 255 детей (123 мальчика и 132 девочек) в возрасте 3 - 18 лет с диабетом 2 - 16-летней давностью. Рост 7,6 % девочек и 13 % мальчиков оказался ниже нормативной границы. Отставание в росте у детей обоих полов проявляется преимущественно в период пубертета. Прослеживалось половое развитие 38 девочек, больных диабетом, на основании возраста появления первой менструации, которая у них опоздала в среднем на 9 месяцев по сравнению со здоровыми девушками.

С целью выделения причин, приводящих к нарушениям роста, был проведен анализ ряда факторов - пола, жительства, возраста начала заболевания, лечения, контроля, осложнений. Установлена зависимость нарушений роста от возраста заболевания (92 % детей заболели диабетом в возрасте под 10 лет), от качества контроля (у 26,6 % детей были установлены частые декомпенсации) и от неадекватности лечения инсулином.