Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 3159-0040
Vol. 1 Issue 5, December - 2014

DYNAMICS IN BODY GROWTH OF CHILDREN WITH DIFFERENT TYPES OF INTRAUTERINE GROWTH RETARDATION

V.A.Schurov, S.O.Ryabykh, A.V.Safonova.
The Federal State-Financed Institution «
Russian Ilizarov Scientific Center for Restorative
Traumatology and Orthopaedics»

***Abstract*—A comparative study of the longitudinal increase in size and body weight in healthy newborns (848) and in children with intrauterine growth retardation (886). When IUGR is observed slowing of weight gain, but also the cranial dimensions and indicators of functional maturity. The dependence of the performance of children of family income, mother's blood pressure and the size of her body. Six years after the birth of children with the effects of the first stage of mental development of IUGR rates close to those of healthy peers.**

Keywords—newborns, body length, anthropometry, abnormal development.

Introduction

In recent decades, the scope of the contingent of doctors came newborns with low birth weight, which is associated in particular with the use of modern neonatal technologies [1]. In children whose birth weight below the 10th percentile for gestational age, there is usually a delay of intrauterine growth retardation (IUGR). Asymmetric intrauterine fetal growth - this lag in the development of the internal organs and the lack of body weight, while maintaining its longitudinal dimensions. It is believed that the asymmetric delay is due to shortage of energy materials and plastic materials that come through the placenta, the fetus or the inability to digest them. The mass of a full-term fetus is not more than 3000 IUGR occurs in 3-7% of all births. In children with IUGR high percentage of diseases, due to their often diagnosable genetically determined, infections and cerebral abnormalities.

Condition of the mother also has a significant impact on the anthropometric parameters of newborns. Are important factors such as the woman's age, weight and length of its body, the parity births. [2] Various explicit or implicit maternal diseases increase the risk of having a child with intrauterine growth retardation [3].

Material costs for nursing of infants with low birth weight are significant [1, 4]. Social significance of the problems after the birth of sick children, as determined by the duration of postnatal adaptation and the need to help these children in later years.

After birth, under favorable conditions, supply children with IUGR first degree in a position to compensate the gap in the longitudinal growth of the body. Remain controversial questions about the possibility of full compensation of mental retardation in these children, the impact of the quality of family life and the nature of women's work in the retention rate of growth of the hereditary nature of this disease.

The purpose of the study - the analysis of the features of the dynamics of growth of the body of children with intrauterine growth retardation of the first degree, the possibility of compensation gaps in physical and mental development of children to preschool age.

Materials and methods

Analyzed data from a survey of healthy full-term infants, male and female, in the control group (848 people)., Which were compared with pregnant women and 886 infants with intrauterine growth retardation of the first degree, who at the time of birth at term (39-42 weeks) of body weight was 2,000 to 2,980 grams (study group). In the study group 1.5 times more frequent in male newborns. Anthropometric differences in male and female subgroups did not go beyond 0.6%. In addition to anthropometric measurements (weight and longitudinal dimensions of the body, the circumference of the head), all newborns were assessed Apgar score. Apgar scores 1 and 2 summarize the Apgar-quantitative assessment of the response newborn baby ectopic environment and, in the absence of asphyxia depend on the degree of his term and functional maturation [6].

Obtained and analyzed data and anthropometric measurements of blood pressure in newborn infants of mothers surveyed referred to the two described groups. These groups included the only resident of the city of Kurgan, with age from 20 to 30 years. Data were collected over a number of years (from 1989 to 2010 with an interval of 1 year), 100 patients with IUGR and 100 healthy children who were born in June. Of the sample of the main group excluded children with weight less than 2000 g, the sample of the control group - premature infants weighing less than 3000 g when analyzing the impact of change over the years, the economic indicators of the

population (according to the Kurgan oblstatupravleniya) on anthropometric measures of body size were taken into account women's bodies a year for women to achieve 18 years of age (the age of the end of the period of the longitudinal growth of the body). Also take into account women's profession, material prosperity of the family. Some of the women from the main group (65 people). Collected medical history of their own body size at birth.

In 86 kindergarten children in Kurgan (6.5 -7 years), including 21 in the child, who had a history of IUGR, were determined by the method of indicators of psychological diagnosis of children's readiness for school [7] on the 6 scales (auditory and visual memory, attention, critical thinking, the arbitrariness of the mental processes, fine motor skills).

Statistical analysis was performed using the data analysis package Microsoft EXEL-2010. To assess the significance of differences results in a normal distribution using the Student's t-test. The text and the table gives the values of the mean values and the error of the mean. The methods of correlation and regression analysis.

Results of the study

The average values of body weight and length in a group of healthy full-term infants were significantly higher than in patients with IUGR (Table 1). Due to the relatively smaller body mass in children with IUGR they were lower than the mass-height index of the Tour. This index in the control group was equal to 66 ± 0,2, while for IUGR - 55 ± 0,2 (p ≤ 0,001). It is of interest that the children of the main group had a significant backlog of body weight (22%), less lag in body length and size of the head, but they had high levels of functional maturity.

Table 1 Anthropometric indicators of healthy and sick newborns with IUGR

Group newborn (number of surveyed)	Weight body (g)	The body length (cm)	Girth of head (cm)	Apgar-1	Apgar-2
The control (848)	**3521** ±37	**52,8** ±0,21	35,4 ±0,05	7,55 ±0,03	8,64 ±0,02
Children with IUGR (886)	**2745** ± 5,7	**49,8** ±0,05	34,0 ±0,04	7,42 ±0,02	8,57 ±0,02
Percentage differences	**-22% P ≤0,001**	**-5,7% P ≤0,001**	-4,1% **P** ≤0,001	-1,6% **P** ≤0,001	-0,8% **P** ≤0,01

If healthy weight children increased in proportion to the longitudinal dimensions of the body (Fig. 1), in patients with IUGR after the longitudinal dimensions of the body 50cm further increase of this parameter was not accompanied by an adequate increase in body weight.

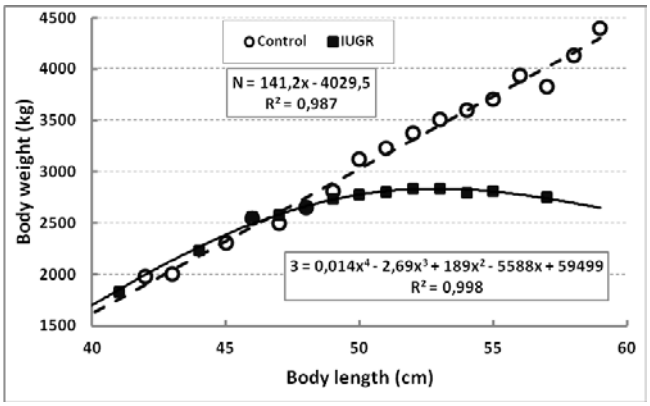

Fig. 1. The relationship of mass and longitudinal dimensions of the body in healthy infants of the control group and patients with IUGR.

The children of the control group in proportion to the length of the body exceeds the size of the head (Fig. 2). The patients of the experimental group has lagged the growth of the head. The average value of the girth of the head when IUGR was 4.1% lower (p ≤ 0,001), than in healthy newborns. Maximum values reached a head circumference in infants of the control group with a body length of 59 cm, in the examined main - at 54 cm (see Fig. 2). If the lag in the dynamics of body weight in children can be attributed to the main group a violation of their food, the fact of detection of stunting head indicates a more complex genesis of the violation. The lag of the main group of children on a scale of functional maturity Apgar Apgar 1 and 2 was, respectively, 1.6% (p ≤ 0,001) and 0.8% (p ≤ 0,001).

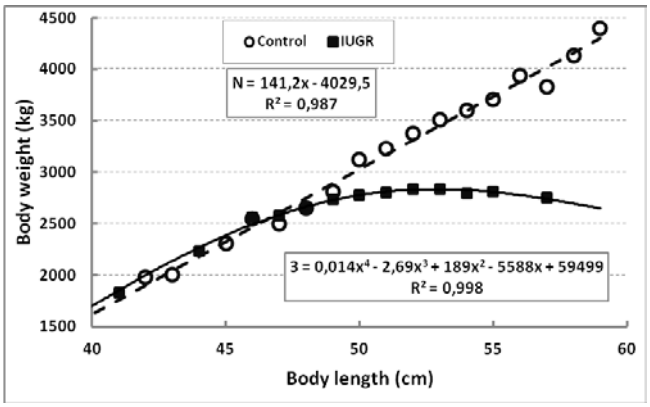

Fig. 2. Longitudinal relationship of body size and newborn head circumference in healthy children of the control group and IUGR.

Increase the longitudinal analysis of the dynamics of body size and head circumference in children of two groups showed that by the end of the first year of life of children between-group differences indicators become insignificant.

In healthy girls of preschool age (6.5-7 years), the mean longitudinal dimensions of the body were 120 ± 1,1 cm in boys 119 ± 0,7 cm, weight - respectively 23 ± 0,5 and 22 ± 4 kg. In children, male and female with the effects of IUGR body length were respectively 115 and 120 ± 2,0 ± 1,5 cm, weight - 19 ± 0,8 (p ≤ 0,01) and 22 ± 1,1 kg. Lagging indicators of mental ill

children was also not significant, and came to the main memory parameters (Fig. 3). Thus, the rate of auditory memory in healthy children was 6,61 ± 0,17, and in the effects of IUGR - 6,05 ± 0,28 points.

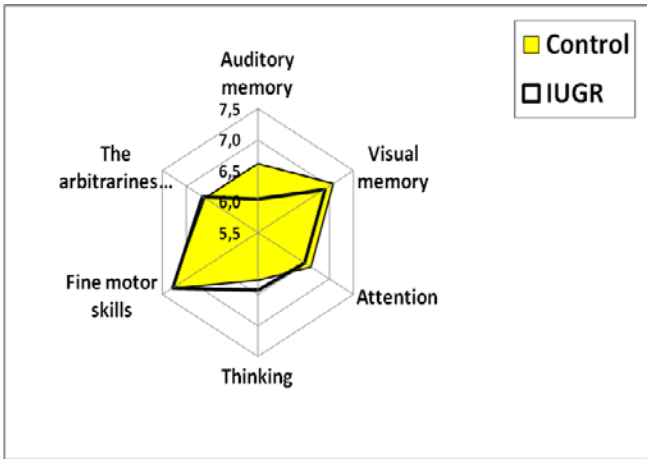

Fig. 3. Indicators of psychological readiness for school (in points) in healthy children and children with the consequences of IUGR.

When analyzing the association of the level of psychological readiness of preschool children to learn in school and their body weight at birth found that the optimal value of the average score (7,5 ± 0,2) was observed in children whose birth weight was 3590 ± 0,013, the degree of backwardness mass (P, r) at birth in patients with IUGR female did not affect the performance of readiness to learn at school, male patients such influence can be traced only by some measures, such as visual memory indicator (M = 0.007 *P-12, 2; r = 0,85).

Consequently, revealed the newborn intrauterine growth can not be explained only as a breach of trophic processes, as accompanied by the slowdown in the growth of the body and the head and to a lesser extent - the dynamics of increasing the performance of functional maturity. In children with first degree lag in the development of IUGR is compensated in the subsequent growth and by the time the children in school is virtually nonexistent.

Discussion of results

1. The influence of the quality of life on the growth and development of children

The deterioration of quality of life in regions of the country, in particular the city of Kurgan, after 1991, was a contributing factor to the slowdown in the bodies of children. [6] In subsequent years, the stabilization of the economic situation arose stunting was not compensated, leading to a further reduction of anthropometric dimensions of the body.

In the analysis of body weight as healthy infants and children with IUGR revealed the dependence of this parameter on the level of family income. Income families with IUGR newborns were significantly lower than the families of children in the control group (Fig. 4).

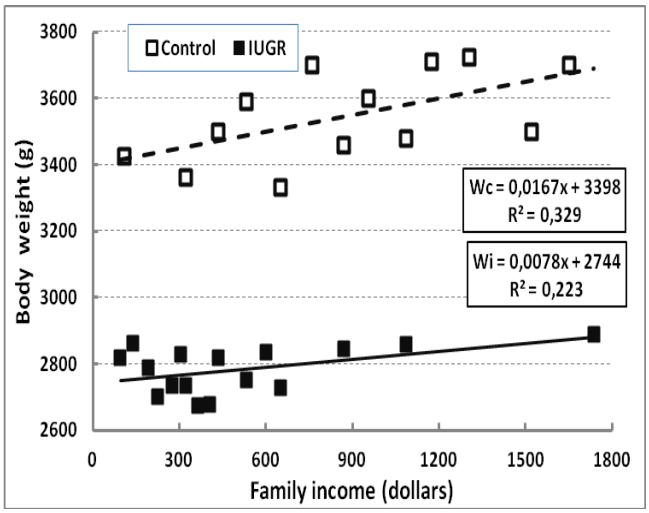

Fig. 4. The dependence of the weights of children in the treatment group and the control of the family's income in terms of money.

The entire group of healthy women, we rank the data, when they reached the age of 18. It turned out that in 1993, the body length of the girls was 166 ± 1,3 cm Index decreased by 2004 to 162 ± 0,4 cm (p ≤ 0,05). In the same period were less than the size of the pelvis is not only pregnant women, but also the size of the body of newborns. In particular - the decreased rate of head circumference in newborns as a control, and in newborns of the main group (Fig. 5).

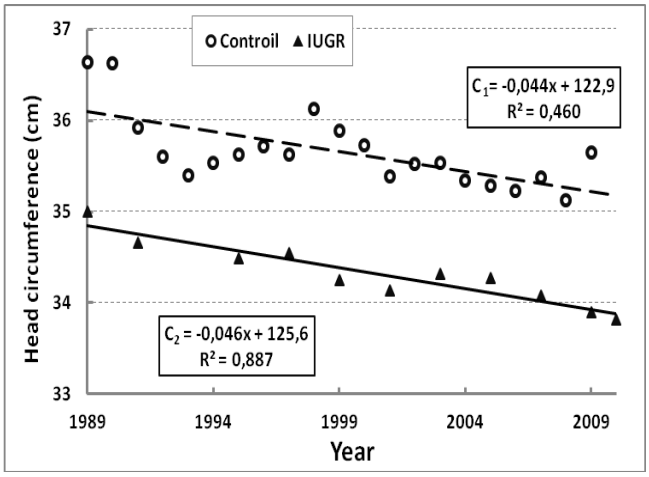

Fig. 5. The dynamics of the head circumference in infants of the control group and the children of the main group.

However, the values of the maturity of the newborn after 1998, despite the reduction in circumference of the head, began to recover in 2006 (Fig. 6). Apgar score-2 in patients with IUGR was not significantly different from the values of the same indicator in the control group and had the same with him the dynamics of change.

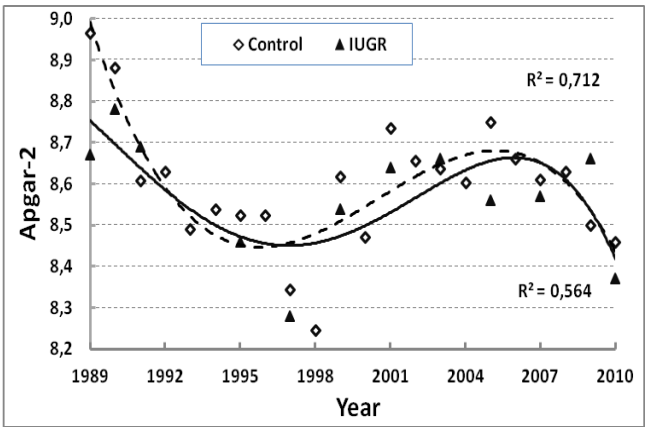

Fig. 6. The changes of the functional maturation of the Apgar-2 healthy full-term infants and children with IUGR.

The increase in performance of functional maturity comes amid some improvement and stabilization of the economic situation in the region studied. At the same time began to decrease the proportion of children born with intrauterine growth retardation (Fig. 7).

One measure of the nutrition of the population in this century is to restore the level of systemic blood pressure of women, which at the end of the last century has decreased from 116 ± 1,1 mm Hg (1990) to 106 ± 2,1 mm Hg. Art. ($p \leq 0,001$). In the first decade of this century, the values of blood pressure was significantly increased and reached 118 ± 1,0 mm Hg The closer a systolic blood pressure of pregnant an established norm (120 mm Hg), the obviously better blood supply to the placenta and conditions of the less common intrauterine growth retardation.

Thus, with a significant deterioration in the quality of life decrease in body size newborn does not happen immediately, but over a number of years. Therefore, short-term periods of natural disasters, famine, war had less impact on neonatal anthropometric measures, the less significant but long-term changes in quality of life [7]. In the early years of the adverse effects of the environment such reduction may be due to malnutrition and accompanied by developmental delay. In subsequent years, reduction in body size of children is apparently suitable biologically adaptive response aimed at reducing the energy requirements of fetal and plastic. As a result of this reaction is a restoration of normal levels of functional development, performance functional maturation of the newborn.

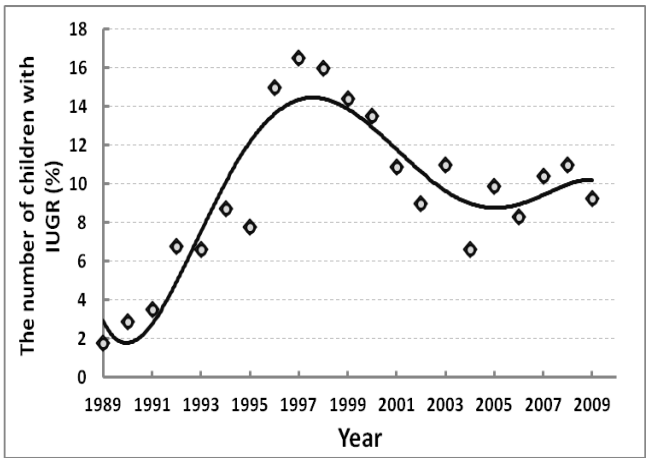

Fig. 7. Dynamics of the number of children born with intrauterine growth retardation (according to the Kurgan city hospital № 2)

2. The role of genetic factors in the emergence of IUGR

It was also found that women who gave birth to children with IUGR have had throughout the study period of observation smaller than his own body Pregnant Women of the control group (respectively 160,9 ± 0,27 and 163,4 ± 0,44 cm, $p \leq 0,001$). After 1991, there was a trend to a reduction of the definitive body size women. Such a reduction in the length of the body in women, which we judged the size attained in the year when they were 18 years old, was observed only in the subjects of the control group. In women, the main group of this size were not only smaller, but remained for the past 20 years at a consistently low level (Fig. 8).

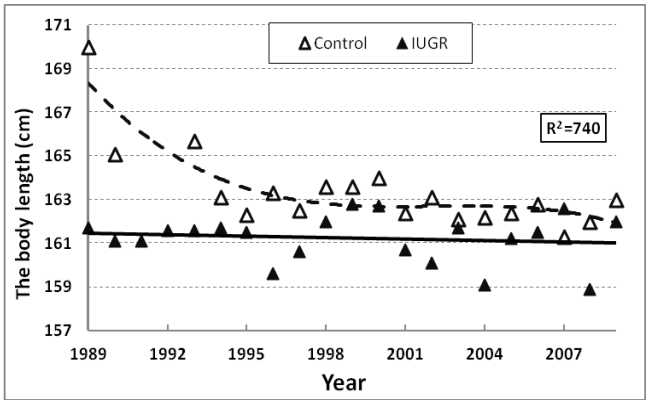

Fig. 8. The dynamics of longitudinal sizes of women aged 18 years who gave birth later to healthy children, and women who delivered babies with IUGR.

Moreover, it was found that the body weight newborns with IUGR were lower, the smaller the weight of their mothers during their own birth (Fig. 9).

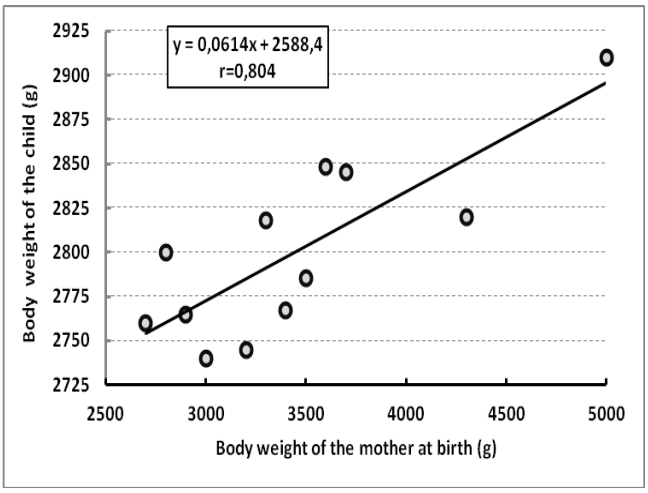

Fig. 9. The relationship of body weight infants with intrauterine growth retardation and body weight, which had their mother in the neonatal period (data averaging 65 observations).

3. The influence of the severity of the disease on the natural growth of children

We have not analyzed the growth of children with birth weight 500-2000 g, as they tend to have very serious injuries are often not compatible with life. Additionally anthropometric measurements of 30 children with severe congenital spinal pathology revealed that they had the parameters as lag parameter from the longitudinal body size the control group (9%, p ≤ 0,001), and on the body mass index (18% p ≤ 0,001). The children of this group with severe pathology of the axial skeleton in the postnatal period, there was compensation for the existing backlog at birth longitudinal sizes characteristic of a group of children with IUGR. Spinal pathology behind these dimensions to the end of the growth period exceeded 12% (Fig. 10).

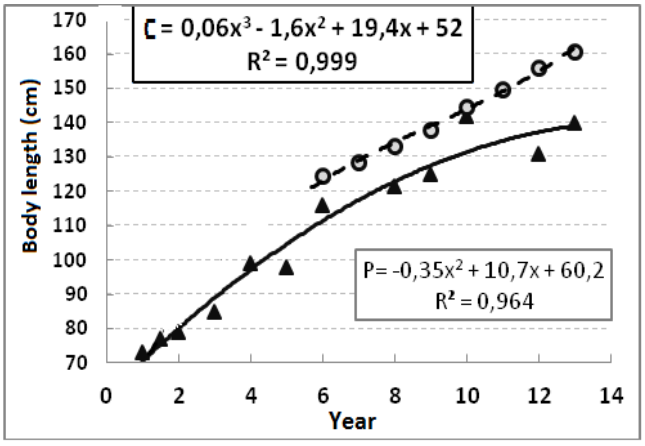

Fig. 10. Age dynamics of longitudinal increase in body size in healthy children in the control group and in patients with malformations of the spine.

4. Compensation mechanisms lag in the longitudinal growth of the limbs

Previously, we investigated the reason for the absence of the negative impact of correcting the delay in the growth of one of the limbs on the growth of the contralateral limb and body [8, 9]. The asymmetry of the length of the lower limbs in bipedia material breach of biomechanical conditions locomotion makes it impossible. Phylogenetically such individuals were eliminated from the population. However, an alternative is to exist in children mechanism to compensate for this defect, for example, by equalizing limb by stimulating the rate of longitudinal growth lagging in length. Thus, according to Yu.A.Tihonova [10], in some cases in children up to 7 years with a lag in the growth of one of the limbs may be accelerating its natural growth and spontaneous adjustment of its length with a healthy.

The consequence of such stimulation is, for example, that patients with the effects of polio definitive dimensions of the long bones of the affected extremity differ far behind the rate of transverse dimensions as compared to longitudinal. It is noted that for children of preschool age with the effects of poliomyelitis characterized by an increase, compared with healthy peers, the level of systemic blood pressure [11]. This does not develop hypertension in children with other crippling diseases. In particular, it is not present in patients with achondroplasia, when there is a significant, but equal to the lag in the growth of both lower extremities [12].

If phylogenetically ancient hydraulic factor can affect the rate of growth of skeletal children, the question arises as to whether the level of blood pressure in women affect the rate of fetal development. Researchers found that pregnant women with hypotension between body mass index of newborns with IUGR (P, r), and systolic blood pressure (D, mm Hg), there is a direct correlation relationship: P = 100 * D -9265,4; r = 0,579 . In pregnant women with elevated blood pressure values of the length and weight of newborns with IUGR is also relatively lower than normal (Fig. 11).

This relationship of blood pressure women and longitudinal sizes newborn due to the fact that for the microcirculation in the placenta of the most favorable conditions, when the systolic blood pressure of pregnant close to the optimum of 120 mm Hg.

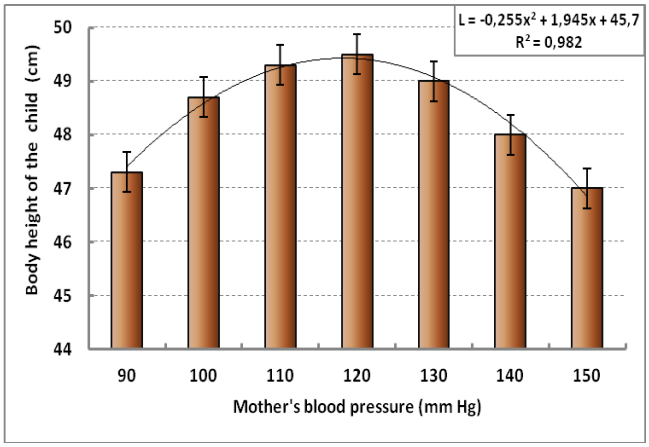

Fig. 11. The longitudinal dimensions of the body newborns with IUGR at different levels of systolic blood pressure childbirth.

IUGR - a specific pathology. Even in children with severe congenital spinal pathology at the time of birth is not observed such a significant decrease in body weight and mass-height index, which is observed in IUGR. In the process of natural longitudinal growth of the body include the development of mechanisms to compensate for imbalances. When IUGR, as with nutritional wasting relatively more impaired weight gain. As shown previously [13], in the first degree of developmental delay children after birth, despite the backlog of weight gain, growth rates remain myocardial mass and dynamics of the increase in blood pressure, which is the basis for the subsequent catch-up growth in the bodies of children.

Findings

1. In newborn infants with intrauterine growth seen slowing in the rate increase is not only weight loss, but also the cranial size. 6 years after the birth rates of mental development of children with the effects of first-degree IUGR close to those of healthy peers.

2. The frequency and severity of IUGR affect the economic situation of the region's population, family history and blood pressure of the mother.

3. In children born at term with malformations of the spine relative to the control group infants were also significantly reduced longitudinal dimensions and weight. In the pathology of the axial skeleton in the postnatal growth retardation of the body is ongoing and longitudinal dimensions of the definitive body of patients were reduced by 10-15%.

References

1. Bombardirova EP, Moses TY, Morozov NA Comprehensive rehabilitation and other premature infants with perinatal lesions in the second phase of the hospital nursing / / Pediatrics, 2001. No 3. - P. 96-99.

2. Zhelohovtseva IN To the method of accelerated learning issues in a group of children / / Health Care. International Journal, 1971. No 2. -P. 145-154.

3. Polyansky D, Sails VN Conformity assessment of the physical development of gestational age newborns. / / Bulletin of the Russian Association of Obstetricians and Gynecologists, 1997. Number three. - P.114-118.

4. Petrov S. Economic consequences of preterm birth and low birthweight //BJOG/ -2003 apr. V. 110. Suppl. 20. –P. 17-23.

5. Schurov VA, AA Kuznetsov, VA Kholodkov The influence of wealth on growth, development and health. Mound. Univ of KSU, 2008. 170 p.

6. Grebenshchikova O. Diagnosis of psychological readiness of children 6-7 years old to go to school. Toolkit. Mound. KSU. 2009.-28 p.

7. Novikov Y. Dynamics of the physical development of infants Leningrad for 45 years (1933-1978) / Y. Novikov, VV Abramchenko, VA Fomin and others / / The protection of motherhood and childhood. - 1981. - V.26. - № 1. - P.62-64.

8. Schurov VA, Shevtsov VI, Ivanova TI, VD Shatohin Hypertension and longitudinal growth in children and adolescents with disorders of the musculoskeletal system / / Pediatrics. 1985. Number three. -P. 40-42.

9. Schurov VA Kudrin BI, Dyakin VM Vlasov SS The growth characteristics of children and adolescents with achondroplasia / / Pediatrics, 1982. No 11. -P. 61-62.

10. Tikhonov YA Uneven growth of limbs in children. / / Mountain. Surgery. 1981. No 6. -P. 39-42.

11. Welner A., Yosipovitsch Z.H., Groen J.J. Elevated blood pressure in children and adolescents with residual paralysis and deformations from poliomyelitis and other crippling diseases //J. chronic Diseases (Engl.). 1966. Vol. 19. No 11-12. –P. 1157-1164.

12. Shevtsov VI Popkov AV Achondroplasia. M. Medicine. 2004 - 300 p.

13. Bochegova IM, Schurov VA, Sazonov, NV The growth characteristics of young children who were born with perinatal CNS pathology and lower extremity // Genius orthopedics. 2002. Number 2. -P. 120-122.

Information about authors

1. Vladimir Schurov

2. FGBU Research Center "Restorative Traumatology and Orthopaedics" them. Acad. Ilizarov Russia, 64 014, Kurgan, str. Mary Ulyanov, 6. www. ilizarov.ru

3. Chief Researcher at the Department of Physiology, Doctor. honey. Sciences, Professor

4. Tel. cl. 8 (3522) 464286, phone home. 8 (3522) 412141

5. E-mail: Shchurovland@mail.ru

6. Russia. S Kurgan, 640 001. Str. Kolya Myagotin. House 95. apartment 49

Ryabykh Sergey O. - Candidate. honey. Sciences, Head of the Spine and Neurosurgery laboratories FGBU "RTO".

Safonova Alena V.

Obstetrician-gynecologist. State Institution Kurgan hospital № 2