FEATURES OF PHYSICAL DEVELOPMENT OF CHILDREN WITH DELAYED INTRAUTERINE DEVELOPMENT IN INFANTRY PERIOD

[1]Khodjamova N.K., [2]Rakhmankulova Z.J.
[1,2]Tashkent Pediatric Medical Institute
https://doi.org/10.5281/zenodo.12739293

Abstract*. This article provides data on the characteristics of the physical development of children with intrauterine growth retardation in infancy. 65 children with IUGR at birth were examined, among which 30 newborns with a symmetrical variant with IUGR made up the 1st subgroup, 35 children with an asymmetric variant of IUGR made up the 2nd subgroup, and the control group included 20 children with average anthropometric data at birth.*

Keywords*: reasonable development of children with delayed internal development; average weight gain in newborns; weight gain.*

Relevance. Intrauterine growth restriction (IUGR, FGR; in the English literature - intrauterine growth restriction and the corresponding abbreviation IUGR) is a nonspecific condition in which the fetus cannot realize its genetically determined growth potential, which is phenotypically manifested by a fetal weight less than normal at the same gestational age in fetuses of the same race and sex [1,7,9].

Experts estimate that approximately 13,7 million babies are born each year with low birth weight (less than 2500 g - WHO definition). In developing countries, up to 11% of all newborns are low birth weight, which is six times higher than in developed countries. The incidence of IUGR varies by country, social group, race and increases with decreasing gestational age, totaling approximately 30 million newborns per year (23.8% of all newborns in the world). The majority of newborns who survive IUGR are in Asia; followed by Africa and Latin America [1,2,7].

Fetuses with IUGR are at high risk of perinatal morbidity and mortality, as well as adverse long-term health consequences, such as impaired neurological and cognitive development, and a high (for the population) risk of cardiovascular and endocrine diseases in adulthood [2,4,5,6].

It has been established that in children with an early phenotype of FGR, indicators of cellular and humoral immunity are significantly reduced [3,4,5]. Due to the course of transient immunodeficiency, there is a weakening of nonspecific protective factors, which causes a high incidence of infectious and inflammatory diseases [1,8,10].

Another aspect of the problem under consideration deserves separate discussion - the features of the physical development of children with early manifestations of IUGR. In 1/3 of children who have signs of the hypoplastic clinical-pathogenetic variant of IUGR at birth, the lag in physical development persists throughout the year. Their body weight deficit ranges from 500 to 2000 g, and their height deficit ranges from 2 to 7 cm [8,9]. In most children born with IUGR, in the first 6–24 months life is marked by a period of rapid growth. In the literature, this phenomenon is called “early growth spurt” [8]. However, approximately 15–20% of children with early IUGR retain low growth rates in the postnatal period [1,2,8].

According to Jelezova M.E. et al (2019) there are also many factors that determine the postnatal growth of a child who has experienced IUGR, such as the specific type of growth

retardation itself (the most important), postnatal food intake, the economic status of the parents and the surrounding social environment. Infants with the symmetrical type of IUGR have poor postnatal growth dynamics and remain small throughout life, since at the time of birth their total cell number was already reduced. Compared with symmetrical IUGR, the asymmetrical type of IUGR has a better prognosis - they have good postnatal growth, since the total number of cells is not affected, and the defect is only in cell size; in such a situation, growth depends on an optimal environment and adequate postnatal caloric intake [11].

Growth or level of development is the main indicator of physical development, serves as an indicator of the socio-economic state of society and a criterion for the well-being of a country.

Purpose of the study: to identify the characteristics of the physical development of children with intrauterine growth retardation in infancy.

Materials and methods of research: Study participants were divided into two groups. The main group included 65 children with IUGR at birth, among which 30 newborns with a symmetrical variant with IUGR formed the 1st subgroup, 35 children with an asymmetric variant of IUGR formed the 2nd subgroup, and the control group included 20 children with average anthropometric data at birth. The criterion for inclusion in the study was the availability of voluntary informed consent from parents to conduct anthropometry within the prescribed time frame. The collection of material (child development card (form No. 112/u “Child Development History”, newborn exchange card) was carried out on the basis of the city children's hospital No. 5 and clinics in Tashkent.

Until one year of age, anthropometry was carried out monthly, with intermediate points at three, six and 12 months of the children’s life. Height was measured using a horizontal stadiometer, and weight was measured using electronic verified scales. Anthropometric studies (measurement of height and weight) were carried out on the basis of the National Standard of Uzbekistan in compliance with the requirements for the technology of performing simple medical services of a functional examination. The obtained data were assessed using centile tables, which made it possible to determine indicators of physical development during the observation period.

Results of the study: at birth, children with intrauterine growth retardation had significantly lower (P <0.001) anthropometric data compared to children in the control group who were born with normal anthropometric data corresponding to the gestational age. These indicators were maintained during the observation period. A comparative analysis between clinical variants showed that in children with a symmetrical variant, anthropometric indicators were significantly lower (P<0.001), (especially height, chest and head circumference) than in children with an asymmetrical variant and are presented in Table 1.

Table 1

Anthropometric indicators in children in the first six months of life

Indicator, M ± m	Children with symmetric IUGR n=30	Children with asymmetric IUGR n=35	Control group n=20
At birth			
Body weight, g	2100.6±326	2265.0 ± 231.1	3343.6 ± 366*
Body length, cm	43.8±2.5	47.3 ± 1.4^	51.8 ± 1.8*
Head circumference, cm	29.1±1.2	33.0 ± 1.2^	34.7 ± 1.3*

Chest circumference, cm	28.1±1.1	31.1 ± 1.9^	32.5 ± 1.6*
3 months of life			
Body weight, g	3703.1±565.2	4102.2 ± 658.3	6367.9 ± 664.7*
Body length, cm	46.9±1.7	58.7 ± 1.85	61.9 ± 2.3*
Head circumference, cm	33.1±1.1	38.2 ± 1.24	40.2 ± 1.5*
Chest circumference, cm	30.3±1.4	34.5 ± 1.96	39.6 ± 1.7*
6 months of life			
Body weight, g	5420±645.3	5925.3 ± 746.3	8232.6 ± 832.0*
Body length, cm	58.0±2.1	64.1 ± 2.3	68.0 ± 2.52*
Head circumference, cm	38.2±1.7	42.2 ± 1.4	43.2 ± 1.42*
Chest circumference, cm	36.1±1.4	41.6 ± 1.9	42.4 ± 2.01*
12 months of life			
Body weight, g	9702±507.2	9809.2±582.6	10345.83±899.8
Body length, cm	69.8±1.4	73.5±1.0	75.8±1.3
Head circumference, cm	47.4±1.3	47.6±1.1	48.1±1.2
Chest circumference, cm	47.6±1.6	48.1±1.3	48.9±1.8

Note: *P<0.001 significant difference between the main group and the control group, ^P<0.001; ^^ P < 0.05 significant difference between subgroups - clinical variants of IUGR.

In the main group, the average weight gain in the first three months of life was 1918 g, which was less than the average weight gain for the indicated period in infants (the required weight gain is from 2500 to 4400g (UNICEF)). The average monthly weight gain in children with IUGR was 639 g, which is significantly lower than the statistical average. In the control group, body weight gain over six months was 3024 g, the average monthly weight gain was about 1000 g. This indicates that children with IUGR in the first months of life, due to a large loss of initial body weight, morphofunctional immaturity of the gastrointestinal tract, enzymatic dysfunction, as well as feeding characteristics, gain less weight than children born with the corresponding weight for gestation.

Analysis of body weight gain among clinical variants showed that in children with the symmetrical variant of IUGR in the first three months of life, the average weight gain was 1976 g, in children with the asymmetrical variant – 2137 g. There was a tendency for higher rates of weight gain in children with IUGR with an asymmetric variant.

The average value of body weight gain in newborn children with IUGR at six months of life was 3826g, which was significantly less than the indicators for children in the control group (5189 g). On average, children in the main group gained 637.7 g each month over the course of six months, and children in the control group gained 864.8g. A comparative analysis between clinical variants did not reveal significant differences in body weight gain.

When analyzing weight gain in observed newborns at one year of age among children of the main and control groups, as well as among clinical variants of IUGR, no significant differences were identified, but in children with IUGR the rate of body weight gain was lower than in children of the control group.

The average rate of body length gain over three months of life in children with IUGR was 8.3 cm, and in the control group the average rate of increase in height was 10.5 cm.

A comparative analysis among IUGR children, depending on the clinical variant, showed that children with an asymmetric variant had a 1.8 times faster rate of increase in height (11.4 cm) than children with a symmetric IUGR variant (8.1 cm).

The average rate of body length gain over six months of life in children with IUGR was significantly (P <0.05) less and amounted to 15.6 cm, while the average increase in this parameter was 16.5 cm. In the control group, the average rate of the increase in height was 17 cm. There was a tendency towards higher growth rates depending on the clinical variant of IUGR. Thus, with IUGR with a symmetrical variant, height gain over six months of life reached 16.2 cm, and with an asymmetrical variant – 16.8 cm.

At 12 months of life in newborns with IUGR, the average increase in height was 10.6 cm, and in the control group almost 8 cm. It follows that children with IUGR from 6 months begin to grow more rapidly in order to achieve normal indicators of one-year-old children (75 cm on average), who had normal anthropometric indicators. No significant differences were found among the clinical variants.

In the first 3 months of life in children with IUGR, the average head circumference is less (P <0.05) than in children of the control group.

At 3 months of life, the average head circumference in children of the main group is smaller (P <0.05) than in children of the 2nd group. Over two months of life in children of groups 1 and 2, the average values of increase in head circumference are almost comparable and amounted to 3.11 ± 0.77 and 3.15 ± 0.84 cm, respectively. An increase in head circumference of more than 3 cm was registered in 15 (25.86%) children of the 1st group and in 18 (32.73%) children of the 2nd group. At the same time, the average values of head circumference in children of the 1st and 2nd groups did not differ significantly (slightly prevailed) from the average values of chest circumference they leveled off (see Table 1).

At 6 months of life, children in group 1 had an average head circumference that was smaller (P <0.05) than in children in group 2. Over three months of life in children of the 1st and 2nd groups, the average values of increases in head circumference are almost comparable and amounted to 3.07 ± 1.06 and 3.19 ± 1.21 cm. An increase in head circumference of more than 4.5 cm was recorded in 3 (5.36%) children of the 1st group and 3 (6%) children of the 2nd group. The average values of head circumference in children of groups 1 and 2 did not differ significantly (slightly prevailed) from the average values of chest circumference. (see Table 1)

Height and body weight in accordance with the age and gender of the child can be determined using centile tables.

Measurements below the 3rd percentile indicate “very low” physical development (occurs in approximately 3% of children); from the 3rd to the 10th percentile - “low” (about 7%), from the 10th to 25th percentile - “below average” (about 15%). Values from the 25th to the 75th percentile are taken as “average” or “conditionally normal values” (50%). The 75th to 90th percentile indicates “above average” (15%), the 90th to 97th percentile indicates “high” (7%), and the 97th percentile and above indicates “very high” growth (in 3%) [10, 11].

Our studies showed that newborns with IUGR had low growth and development in the first 6 months of life. When comparing our data with the data in the table, we found that in the first 3 months of life, the average value of weight gain in newborns with symmetrical and asymmetrical IUGR was below the 3rd percentile, this indicates a “very low weight” indicator of physical development.

Analysis of growth data showed that the growth of newborns with a symmetrical variant corresponded to below the 3rd percentile - “very short stature”, and the growth of children with an asymmetrical variant corresponded to the 10th percentile - “low stature”. The average weight of children in the control group - children born without intrauterine growth retardation according to the centile table - corresponded to the 90th percentile, which indicates a high increase in weight gain.

It follows from this that newborn with IUGR in weight and height development in the first three months lag behind newborns born without intrauterine growth retardation.

At 6 months, children with IUGR correspond to average weight values according to the centile table - from 3 to 10 percentiles, this indicates “low growth” of weight gain. In the control group, the average weight gain corresponded to the 75th to 90th percentile, indicating “above average” weight gain.

The average height values at 6 months in newborns with IUGR corresponded to the 10th percentile. In children of the control group, this indicator corresponded to from 75 to 90 percentiles.

A comparative analysis between clinical variants showed that the average height in newborns with a symmetrical variant of IUGR was lower and corresponded to - 3 percentiles (very low growth), and the height of children with an asymmetric variant corresponded to - from 25 to 50 percentiles, this indicates “conditionally normal” magnitude." This shows that newborns with an asymmetric IUGR variant are approaching normal values by 6 months.

At 12 months of life, the average weight values in newborns with IUGR corresponded to the 50th percentile, which indicates “normal values”. No significant differences were found among the clinical variants of IUGR.

The average growth rates in the group of children with IUGR according to the centile table corresponded to from 25 to 50 percentiles, this indicates conditionally normal growth in body length. In the control group, this indicator corresponded to the 50th percentile of normal body length growth.

We also studied the harmony of physical development according to the weight and height index (Figure 1).

Harmonious physical development (correspondence of body weight to the child’s height) was recorded in 43% of children with an asymmetrical variant of IUGR at the age of six months, disharmonious (body weight deficiency) – in 57% of children. In the group of children with the symmetrical variant, these figures were 76% and 24%, respectively.

At the age of 12 months, in children with an asymmetrical variant of IUGR, harmonious physical development was registered in 86% of cases, disharmonious - in 14%, in the group with a symmetrical comparison variant - in 88 and 12% of cases. Disharmonious development was associated with underweight.

Conclusions: Thus, newborns with IUGR in weight and height development in the first six months lag behind newborns born without intrauterine growth retardation due to increased morbidity in early infancy.

From 6 months, the growth rate of weight and length of the body of newborns with IUGR increases almost 2 times compared to newborns born without intrauterine growth retardation and almost reach the average indicators of physical development at 12 months of life.

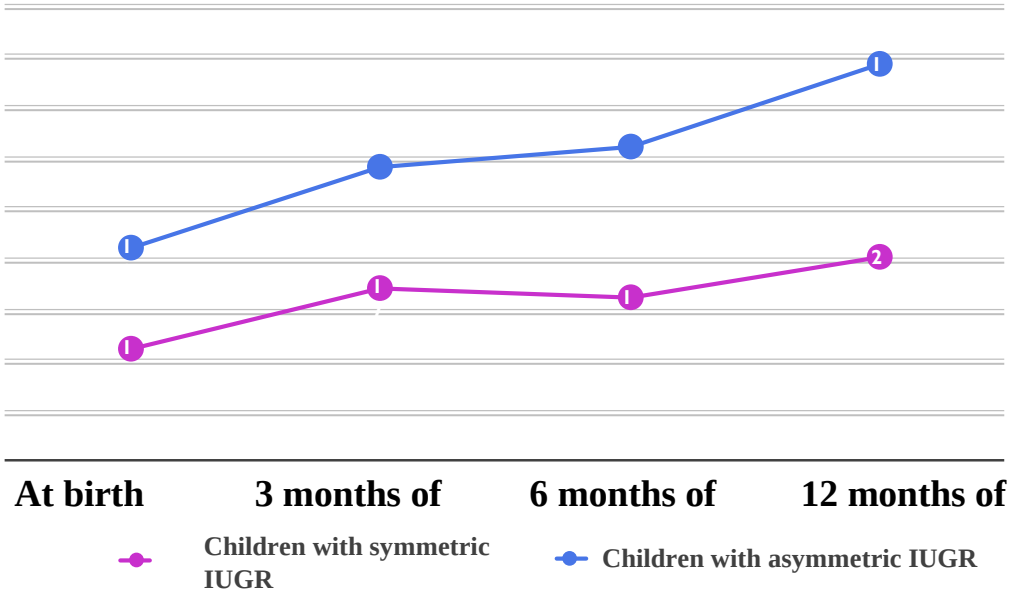

Fig.1. Masso - height index

REFERENCES

1. Bliznetsova E.A., Antonova L.K. Features of physical development in the first year of life of premature children born with intrauterine growth retardation // FORCIPE. 2022; 5(S2): 74-75.
2. Burlutskaya A.V., Shadrin S.A., Statova A.V. Physical development of children born with intrauterine growth retardation // Effective pharmacotherapy. 2019; 15(43): 20–24. DOI 10.33978/2307-3586-2019-15-43-20-24
3. Calek, E.; Binder, J.; Palmrich, P.; Eibensteiner, F.; Thajer, A.; Kainz, T.; Harreiter, K.; Berger, A.; Binder, C. Effects of Intrauterine Growth Restriction (IUGR) on Growth and Body Composition Compared to Constitutionally Small Infants. Nutrients 2023, 15, 4158. https://doi.org/10.3390/nu15194158
4. Dolgushina V.F., Vereina N.K., Fartunina Yu.V., Nadvikova T.V. Fetal growth restriction: is it always hypotrophy of a newborn? // Practical Medicine. 2020; 18(2): 28-34
5. Elezova A. A., Botoeva E. A. Comparative Analysis of the Causes of Intrauterine Growth Retardation. Bulletin of Buryat State University. Medicine and Pharmacy. 2021; 2: 29–39
6. Khodjamova, N. K., Akhmedova, Z. M., Khamdamova, R. Kh. Perinatal risk factors predisposing to the birth of low-birth-weight babies with bacterial infection // Children's Medicine of the North-West. 2020; *8*(1): 363-363.
7. Khodjamova, N.K., Rakhmankulova, Z.J., Gulyamova, M.A. The importance of risk factors in the formation of an asymmetric variant of intrauterine growth retardation // FORCIPE. 2022; 5(S2): 526.
8. Lipatov I.S., Tezikov Yu.V., Amosov M.S., Zumorina E.M. Clinical and pathogenetic variants of fetal growth restriction with different periods of manifestation. Meditsinskiy sovet = Medical Council. 2021; (3): 54–65. doi: 10.21518/2079-701X-2021-3-54-65.

9. Rakhmankulova, Z. J., Saydalieva, N. M., Tursunkhodzhaeva, N. A., Khodjamova, N. K. Comparative characteristics of risk factors in full-term and premature newborns with intrauterine growth retardation // Young scientist. 2018; 5: 67-70.
10. Xianping Huang, Huiqiu Xiang, Jiale Bao, Jing Zhu, Jiajia Chen, Panpan Zhou, Tong Zhou & Zhangye Xu (2023) The effects of intrauterine growth on physical and intellectual development of one-year-old infants: a study on monochorionic twins with selective intrauterine growth restriction, Journal of Obstetrics and Gynaecology, 43:1, 2125300, DOI: 10.1080/01443615.2022.2125300
11. Jelezova M.E., Zephirova T.P., Kanyukov S.S. Fetal growth retardation: modern approaches to the diagnosis and management of pregnancy // Practical medicine. 2019; 17(4): 8-14
12. Khodjamova N., Rakhmankulova Z., Khamidullayeva N. THE STRUCTURE OF MORBIDITY IN PREMATURE INFANTS WITH AN ASYMMETRIC VARIANT OF INTRAUTERINE GROWTH RETARDATION IN THE NEONATAL PERIOD //Science and innovation. – 2024. – Т. 3. – №. D5. – С. 318-323.
13. Рахманкулова З. Ж., Абдукодирова М. К., Сулейманова Л. И. Характеристика частоты встречаемости клинических признаков поражения органов дыхания у новорожденных детей с цитомегаловирусной инфекцией //Children's Medicine of the North-West. – 2020. – Т. 8. – №. 1. – С. 410-410.
14. Ходжамова Н. К., Рахманкулова З. Ж., Камалов З. С. Особенности гемодинамических изменений у недоношенных новорожденных с задержкой внутриутробного развития, родившихся в асфиксии //Журнал теоретической и клинической медицины. – 2015. – №. 3. – С. 97-99.
15. Рахманкулова З. Ж. Клинико-иммунологические параллели при сочетанных внутриутробных инфекциях у новорожденных //Перинатология и педиатрия. – 2009. – №. 2. – С. 26-26.