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ASSESSMENT OF BODY LENGTH IN INFANTS BORN WITH DIFFERENT TYPES OF MILD PRENATAL DEVELOPMENT DELAY

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Objective. To assess the length of the body in infants from mothers with a burdened somatic and obstetric-gynecological history, including with a delay in the growth of the fetus of various types of mild severity, in comparison with each other, with healthy children from practically healthy mothers and with children from mothers with an aggravated somatic and obstetric-gynecological history, but without delayed fetal growth. **Material and methods.** 166 new-borns were monitored since birth, including 72 infants born after abnormal pregnancies with mild foetus growth and development retardation (gr. 1), and 69 infants born after abnormal pregnancies, but without any retardation (gr. 2), born by mothers with previous somatic and gynaecological disorders. The symmetrical intrauterine growth and development retardation was diagnosed in 15 infants (20.83%) (subgr. 1b), whereas the dissymmetric retardation was diagnosed in 57 children (79.17%) (subgr. 1a) from gr. 1. Practically healthy infants born by practically healthy mothers after normal pregnancies made up gr. 3 (25 subjects). Children are full-term, looked round in 1 (154), 3 (138), 6 (131), 12 (119 children) months. Comprehensive analysis of history, inspection, body height. Distribution-free statistical analysis methods. **Results.** The differences ($p < 0.01$) in body length (Me, cm) in children at birth between the subgr. 1b (48) and gr. 2 (52); in 1 month between subgr. 1a (53) and 1b (52.5); in 3 months between subgr. 1a (60) and gr. 2 (62); in 6 months between subgr. 1a (66.5) and 1b (65.5); in 12 months between subgr. 1a (74.25) and 1b (73), subgr. 1a and gr. 2 (76), subgr. 1b and gr. 2. Increase of body length to 1 month in children subgr. 1a (4) and 1b (4.5) in comparison with children gr. 2 and 3 by 1 and 1.5 cm respectively more; to 3 months in children subgr. 1a (7) and gr. 2 (7) are comparable and more than children subgr. 1b. by 0.5 cm, gr. 3 by 1 and 0.5 cm respectively; to 6 months in children subgr. 1a (6.5) and 1b (6.5) more than the gr. 2 by 0.5 cm, less than the children gr. 3 by 0.5 cm; to 12 months in children subgr. 1a and 1b; gr. 1, 2 and 3 are comparable. To 12 months in children subgr. 1b in relation to children gr. 2 and 3 less by 0.5 cm. **Conclusion.** The established difference in body-length should be taken into account during the dispensary observation in order to decide whether to carry out corrective measures.

Keywords: body height; infants; intrauterine growth and development retardation.

ОЦЕНКА ДЛИНЫ ТЕЛА У ДЕТЕЙ ГРУДНОГО ВОЗРАСТА, РОЖДЕННЫХ С ЗАДЕРЖКОЙ ВНУТРИУТРОБНОГО РАЗВИТИЯ РАЗНЫХ ТИПОВ ЛЕГКОЙ СТЕПЕНИ ТЯЖЕСТИ

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Цель. Оценить длину тела у детей грудного возраста от матерей с отягощенным соматическим и акушерско-гинекологическим анамнезом, в том числе с задержкой роста плода разных типов легкой степени тяжести, в сравнении между собой, со здоровыми детьми от практически здоровых матерей и с детьми от мате-

рей с отягощенным соматическим и акушерско-гинекологическим анамнезом, но без задержки роста плода. **Материалы и методы.** С рождения наблюдались 166 детей. Из них рождены в исходе осложненных беременностей, в том числе с задержкой роста плода легкой степени тяжести 72 (1-я группа) и без таковой 69 (2-я группа) матерями с отягощенным соматическим и гинекологическим анамнезом. Задержка внутриутробного развития гипопластического типа диагностирована у 15 (20,83 %) детей (подгруппа 1б), гипотрофического типа — у 57 (79,17 %) (подгруппа 1а) детей 1-й группы. Практически здоровые дети, рожденные от практически здоровых матерей в исходе физиологических беременностей, составили 3-ю группу — 25 детей. Дети доношенные осматривались в 1 (154), 3 (138), 6 (131) и 12 (119 детей) мес. Произведен комплексный анализ данных анамнеза, осмотра, длины тела. Применены непараметрические методы статистического анализа. **Результаты.** Доказаны различия ($p < 0,01$) длины тела (Me, см) у детей при рождении между подгруппой 1б (48) и 2-й группой (52); в 1 мес. между подгруппами 1а (53) и 1б (52,5); в 3 мес. между подгруппой 1а (60) и 2-й группой (62); в 6 мес. между подгруппами 1а (66,5) и 1б (65,5); в 12 мес. между подгруппами 1а (74,25) и 1б (73), подгруппой 1а и 2-й группой (76), подгруппой 1б и 2-й группой. Прибавка длины тела к 1 мес. у детей подгрупп 1а (4) и 1б (4,5) в сравнении с детьми 2-й и 3-й групп на больше 1 и 1,5 см соответственно; к 3 мес. у детей подгруппы 1а (7) и 2-й группы (7) сопоставима и больше, чем у детей подгруппы 1б на 0,5 см, 3-й группы на 1 и 0,5 см соответственно; к 6 мес. у детей подгрупп 1а (6,5) и 1б (6,5) больше, чем у детей 2-й группы на 0,5 см, меньше чем у детей 3-й группы на 0,5 см; к 12 мес. у детей подгрупп 1а и 1б; 1, 2 и 3-й групп сопоставима. К 12 мес. у детей подгруппы 1б в сравнении с детьми 2-й и 3-й групп меньше на 0,5 см. **Выводы.** Задержка внутриутробного развития даже легкой степени тяжести определяет изменения со стороны длины тела детей грудного возраста, что необходимо учитывать при диспансерном наблюдении для проведения корригирующих мероприятий.

Ключевые слова: длина тела; дети; задержка внутриутробного развития.

INTRODUCTION

Despite the prominence and knowledge of the consequences of intrauterine growth retardation (IUGR) [1, 2, 4–12], doctors do not focus on the correct and adequate assessment of physical development and its changes in infants, which does not enable to prevent timely an individual's health disorder in the subsequent stages of growth and development. These disorders can appear in the form of delayed puberty or short stature. The aforesaid is confirmed by the fact that these pediatric patients are discharged from the departments of physiology of newborns in perinatal centers as practically healthy and are then monitored in outpatient medical care facilities.

The work aimed to compare between the body height in infants born to mothers with a burdened somatic, obstetric, and gynecological history, including those with fetal growth retardation of different types of mild severity, and healthy children born to practically healthy mothers, as well as pediatric patients without fetal growth retardation, born to mothers with a burdened somatic, obstetric, and gynecological history, but without fetal growth retardation.

MATERIALS AND METHODS

A nonrandomized controlled comparative prospective cohort study was conducted. The material was collected during 2014–2017 from the departments of physiology of newborns and consultative and diagnostic departments of the perinatal centers of clinics of the Saint Petersburg State Pediatric Medical University and V.A. Almazov National Medical Research Center in Saint Petersburg.

Fetal growth retardation was initially diagnosed by gynecologists, and subsequently, the diagnosis of IUGR was confirmed by neonatologists, which was documented. All newborns diagnosed with IUGR had body mass indices lower than the P_{10} percentile (less than two standard deviations) compared with those appropriate for gestational age (i.e., the gestational age at which the baby was born). All newborns with mild hypotrophic IUGR had a body weight in the range of percentiles P_{10}–P_3 (1.5–2 standard deviations) with normal or moderately reduced body height relative to the gestational age. All newborns with mild hypoplastic IUGR had a weight and body height below the percentile P_3 (less than the standard deviation 2) relative to the gestational age.

The infants were enrolled in the study group in parallel, since birth. The criteria for inclusion of pediatric patients in the compared groups were the physiological course of pregnancy in practically healthy mothers and complicated pregnancies, including those with fetal growth retardation of various types of mild severity, as well as those without it, in women who had a burdened somatic and gynecological history, with delivery at weeks 37–42.

During the first year of life, three groups of full-term pediatric patients were monitored, namely, groups 1, 2, and 3. Group 1 included pediatric patients born to mothers with a burdened somatic, obstetric, and gynecological history, including fetal growth retardation. Group 2 included pediatric patients born to mothers with a burdened somatic, obstetric, and gynecological history, but without fetal growth

retardation. Group 3 included practically healthy children born to practically healthy mothers in the outcome of the physiological course of pregnancy. Hypotrophic IUGR was diagnosed in 57 pediatric patients (subgroup 1a), and hypoplastic IUGR was diagnosed in 15 patients (subgroup 1b). The examination points were days 2–3 as well as months 1, 3, 6, and 12 of the pediatric patients' lives (Table 1).

The study did not include infants born with IUGR due to hereditary and infectious factors. Additional studies and subgroups for their inclusion were not planned.

Group 1 included newborns with a body weight of 2720 g (2540–2840); 55 of these pediatric patients (76.39%) were born through vaginal delivery. Subgroup 1a included pediatric patients with a body weight of 2770 g (2600–2900). Subgroup 1b included patients with a body weight of 2390 g (2300–2590). Group 2 included newborns with a body weight of 3350 g (3020–3650); 59 of them (85.51%) were born through vaginal delivery. Group 3 included newborns with a body weight of 3350 g (3250–3450), which were born through vaginal delivery. The median body weight (measured in grams) in pediatric patients of group 1 and subgroups 1a and 1b was lower in comparison with pediatric patients of group 2, while it was greater in pediatric patients of subgroup 1a in comparison with pediatric patients of subgroup 1b. The median body weight in pediatric patients of subgroup 1b was lower compared with pediatric patients of group 3 ($p < 0.01$, Kolmogorov–Smirnov test). Estimation of body weight of newborns included in the study is presented in Table 2.

The outcome was registered by V.V. Derevtsov, which included a comprehensive analysis and assessment of medical history, physical examination, and measurement of body height according to standard methods using a height meter [3].

The newborns included in the study were overwhelmingly discharged from the physiology departments of newborn perinatal centers on days 3–5 of life.

Forty-nine (85.96%) pediatric patients of group 1, 48 (78.69%) pediatric patients of group 2, and 22 (88%) pediatric patients of group 3 were breastfed up to three months of life; 42 (76.36%) pediatric patients of group 1, 38 (70.37%) of the pediatric patients of group 2, and 20 (80%) of the pediatric patients of group 3 were breastfed up to six months of life; 12 pediatric patients of group 1, 12 pediatric patients of

Table 1 / Таблица 1

Tumber of examined children of studied age periods
Количество обследованных детей в изучаемые возрастные периоды развития организма

Age / Возраст	Number, *n* (abs.) / Количество пациентов, *n* (абс.)				
	Group 1 / 1-я группа			Group 2 / 2-я группа	Group 3 / 3-я группа
	Total / Всего	Subgroup 1a / Подгруппа 1а	Subgroup 1б / Подгруппа 1б		
At birth / При рождении	72	57	15	69	25
1 month / 1 месяц	64	40	14	65	25
3 months / 3 месяца	58	46	12	55	25
6 months / 6 месяцев	56	43	13	50	25
12 months / 12 месяцев	46	36	10	48	25

Table 2 / Таблица 2

Assessment of descriptive statistics of body weight (g) in newborns at birth
Оценка результата описательной статистики массы тела (г) у новорожденных при рождении

Indication / Показатель	*n*	*Me*	min	max	Q_{25}	Q_{75}	Scope / Размах	Interquartile scope / Интерквартильный размах
Mass of a body, g / Масса тела, г								
Subgroup 1a / Подгруппа 1а	57	2770	2120	3100	2600	2900	980	300
Subgroup 1б / Подгруппа 1б	15	2390	1960	2870	2300	2590	910	290
Group 1 / 1-я группа	72	2720	1960	3100	2540	2840	1140	300
Group 2 / 2-я группа	69	3350	2630	4070	3020	3610	1440	590
Group 3 / 3-я группа	25	3350	3100	3650	3250	3450	550	200

Note. *n* – quantity, *Me* – median body weight in grams, min – minimum value, max – maximum value, Q_{25}, and Q_{75} – 25th and 75th percentiles respectively. *Примечание.* *n* — количество. *Me* — медиана массы тела в граммах, min — минимальное значение, max — максимальное значение, Q_{25}, Q_{75} — 25-й и 75-й процентили соответственно.

group 2, and seven pediatric patients of group 3 were breastfed up to 12 months of life.

All stages of the study conformed to the legislation of the Russian Federation, international ethical standards, and regulatory documents of research organizations and were approved by the relevant committees, including the ethics committees of the V.A. Almazov National Medical Research Center (extract from protocol no. 59 dated March 17, 2014) and the Saint Petersburg State Pediatric Medical University (extract from protocol no. 12/3 of December 4, 2017).

During the study, there was no shift in time intervals. No medical interventions were planned. Participation in the study was terminated at the voluntary request of legal representatives and with the end of the planned follow-up period. There were no specific factors that could affect the external generalizability of the study findings.

Statistical Analysis. The sample size was not previously calculated and was imposed according to the scientific and ethical considerations. A software package for statistical analysis StatSoft Statistica v 6.1 was used. The parameters of quantity (n), median (Me), quartiles (Q_{25}; Q_{75}), minimum (min) and maximum (max) values, interquartile range, and confidence interval (p) were calculated. Two independent groups were compared using the nonparametric Kolmogorov–Smirnov test. The results of the correlation analysis of indicators were evaluated using the statistical analysis of Spearman's rank correlation. The differences were considered statistically significant at $p < 0.05$.

STUDY RESULTS

Data analysis of descriptive statistics of body height in pediatric patients of the first year of life, presented in Table 3, proved ($p < 0.01$, the Kolmogorov–Smirnov test) that the median body height at birth in pediatric patients of subgroup 1b is lower in comparison with pediatric patients of group 2b. It was greater in pediatric patients of subgroup 1a compared to pediatric patients of subgroup 1b at the age of one month. It was lower in pediatric patients of subgroup 1a compared to pediatric patients of the group 2 at the age of three months. It was greater in pediatric patients of subgroup 1a compared to pediatric patients of subgroup 1b at the age of 6 months. It was greater in pediatric patients of subgroup 1a compared to pediatric patients of subgroup 1b and lower in pediatric patients of subgroups 1a and 1b compared to pediatric patients of group 2 at the age of 12 months.

Median increase in body height from birth to the age of one month in pediatric patients of subgroups 1a and 1b (4 and 4.5 cm, respectively) is 1 and 1.5 cm greater, respectively, compared to pediatric patients of groups 2 and 3 (3 and 3 cm, respectively). In pediatric patients of subgroup 1a and group 2, aged one to three months, it is comparable (7 cm), 0.5 cm greater compared to pediatric patients of subgroup 1b, and 1 and 0.5 cm greater, respectively, compared to pediatric patients of the group 3. In pediatric patients of subgroups 1a and 1b, aged three to six months, it is comparable (6.5 cm each), 0.5 cm greater compared to pediatric patients of group 2, and 0.5 cm lower compared to pediatric patients of group 3. In pediatric patients of subgroups 1a and 1b and groups 1, 2, and 3, aged six to twelve months, it is comparable. However, in pediatric patients of subgroup 1b, aged six to twelve months, it is 0.5 cm lower, compared to pediatric patients of groups 2 and 3 (Table 3).

DISCUSSION

The data characterizing the aspects of the physical development of pediatric patients born with mild IUGR, obtained in our study, coincide in part with the findings of other scientists [2, 4, 10]. Researchers Islamova K.F. et al. [2] stated that the body height in pediatric patients born with IUGR reaches age standards of three months of life. We did not record significant differences in body height during the observed periods of the body development in pediatric patients of group 1 and subgroups 1a and 1b compared to pediatric patients of group 3. However, in pediatric patients of subgroup 1a, lower values of body height at the age of three and 12 months was proved compared to pediatric patients of the group 2. In pediatric patients of subgroup 1b, lower values of body height at the age of 12 months was proved compared with pediatric patients of group 2. In pediatric patients of subgroup 1a, higher values of body height at the age of one, six, and 12 months was proved compared to pediatric patients of subgroup 1b.

An analysis of the median increase of body height revealed that, in pediatric patients of group 1, higher values were found at the age of 1 and 3 months and lower values were found at the age of 6 months compared to the pediatric patients of group 3, and compared to pediatric patients of group 2, greater values were found at the age of one month. In pediatric patients of subgroup 1a, compared to pediatric patients of group 2, a greater median increase of body height at the age of one and six months was proved, and compared to pediatric patients of the group 3, a greater value was proved at the age of one and three months and a lower value was proved at the age of six months. In pediatric patients of subgroup 1b, compared to pediatric patients of group 2, a greater median increase of body height at the age of one and six months and a lower median at the age of three and

Table 3 / Таблица 3

Evaluation of the result of descriptive statistics of body length (cm) in children of the first year of life
Оценка результата описательной статистики длины тела (см) у детей первого года жизни

Indication / Показатель		*n*	*Me*	min	max	Q_{25}	Q_{75}	Scope / Размах	Interquartile scope / Интерквартильный размах
Subgroup 1a / Подгруппа 1а	At birth / При рождении	57	49.00	47.0	52.0	48.0	50.0	5.0	2.00
	1 month / 1 месяц	50	53.00	50.0	56.5	51.5	54.5	6.5	3.00
	3 months / 3 месяца	46	60.00	56.5	63.0	59.0	61.0	6.5	2.00
	6 months / 6 месяцев	43	66.50	62.0	72.0	65.0	67.5	10.0	2.50
	12 months / 12 месяцев	36	74.25	68.5	81.0	73.0	76.5	12.5	3.50
Subgroup 1б / Подгруппа 1б	At birth / При рождении	15	48.00	45.0	50.0	47.0	49.0	5.0	2.00
	1 month / 1 месяц	14	52.50	47.0	55.0	51.0	54.0	8.0	3.00
	3 months / 3 месяца	12	59.00	56.0	62.5	57.6	60.0	6.5	2.35
	6 months / 6 месяцев	13	65.50	61.0	68.5	63.5	66.5	7.5	3.00
	12 months / 12 месяцев	10	73.00	69.0	76.5	72.0	75.0	7.5	3.00
Group 1 / 1-я группа	At birth / При рождении	72	49.00	45.0	52.0	48.0	50.0	7.0	2.00
	1 month / 1 месяц	64	53.00	47.0	56.5	51.5	54.5	9.5	3.00
	3 months / 3 месяца	58	59.75	56.0	63.0	58.5	61.0	7.0	2.50
	6 months / 6 месяцев	56	66.10	61.0	72.0	64.5	67.5	11.0	3.00
	12 months / 12 месяцев	46	74.00	68.5	81.0	72.5	76.0	12.5	3.50
Group 2 / 2-я группа	At birth / При рождении	69	52.00	49.0	57.0	50.0	53.0	8.0	3.00
	1 month / 1 месяц	56	55.00	50.5	63.0	54.5	56.75	12.5	2.25
	3 months / 3 месяца	55	62.00	56.0	69.5	60.5	63.5	13.5	3.00
	6 months / 6 месяцев	50	68.00	62.0	73.0	66.0	70.0	11.0	4.00
	12 months / 12 месяцев	48	76.00	69.0	82.0	74.5	78.5	13.0	4.00
Group 3 / 3-я группа	At birth / При рождении	25	51.00	49.5	53.0	50.5	52.0	3.5	1.50
	1 month / 1 месяц	25	54.00	53.0	56.0	53.5	55.0	3.0	1.50
	3 months / 3 месяца	25	60.00	58.0	62.0	59.0	61.0	4.0	2.00
	6 months / 6 месяцев	25	67.00	64.5	69.0	66.0	67.5	4.5	1.50
	12 months / 12 месяцев	25	75.00	73.0	78.0	74.5	76.0	5.0	1.50

twelve months were proved, and compared to pediatric patients of the group 3, a greater value at the age of one and three months and a lower value at the age of six and twelve months were proved. In pediatric patients of subgroup 1a, compared to pediatric patients of subgroup 1b, the median increase of body height was of a lesser value at the age of one month and of a greater value at the age of three months. These data reveal the pattern of growth retardation in pediatric patients born with IUGR starting from the second half of life, in especially those with the hypoplastic type, and the variability of gains.

CONCLUSION

IUGR of even mild severity of the hypoplastic and hypotrophic types determines changes in the body height and its growth dynamics in infants, which should be taken into account by doctors when they follow up the case for timely identification of possible disorders in the long term in order to resolve the issue of the appropriateness of corrective events.

CONFLICTS OF INTEREST

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