


The Predictive Value of the Mother's Risk Factors in Formation of Fetal Developmental Delay

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Abstract

The research aimed at studying the mother's social-hygienic and medical biological risk factors and determining their predictive value. The retrospective case-control study was conducted with 142 pregnant women participating in it. In the case group there were involved 92 mothers whose pregnancy was completed by the birth of a newborn baby suffering from the intrauterine growth restriction. The control group was made of 50 pregnant women, whose pregnancy was completed by the birth of a healthy neonate. The research resulted in specifying the risk factors of high priority: the low standards of living (OR 3.61), chronic stress (OR-3.06), sleeping disorder (OR-3.33) and poor nutrition (OR-3.81). As regards the coexisting pathology the following was revealed: endocrine pathology (OR-3.27), ischemic heart disease (OR-4.35), arterial hypertension (OR-6.47), iron deficiency anemia (OR-4.11), pathology of respiratory system (OR-3.42), chronic genital inflammatory and infectious processes. The preeclampsia (92%) and low amniotic fluid (89%) were detected to have the high predictive value. The awareness of risk factors allows us to employ the timely measures for the reduction of negative impact on the fetus and neonate.

Keywords

developmental delay, fetal, intrauterine, genital pathology, growth restriction

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The investigation of causes of forming the syndrome of fetal developmental delay is a topical issue of perinatology. The above mentioned is conditioned by increasing tendency towards the spread of disease, frequency of complications and negative impact on further health conditions of children. Fetal developmental delay was acknowledged as “the most common and complex problem of modern obstetrics”^{1,2} by Board of American Obstetrician- Gynecologists in 2013.

According to popular studies conducted in recent years the spread of fetal developmental delay equals to 10 to 44% on average. Based on the data of a number of authors, the disease is registered in every 10th pregnancy and 3 to 8% of newborn babies suffer from it.³ Fetal developmental delay is related to high risk of perinatal illnesses: chronic hypoxia, hyperbilirubinemia (elevated bilirubin), hypoglycemia, respiratory and neurological disorders (12%).⁴ Fetal developmental delay is the most considerable cause of neonates' stillbirth, that accounts for fourfold increase of its coefficient.^{3,5} Decrease in cognitive function and

the development of metabolic syndromes in children are considered to be long-term complications of the disease.⁴

Nowadays, there exist a fair amount of information about etiology and pathogenesis of fetal developmental delay. Hypotrophy of fetus is a poly -etiologic process, in formation of which maternal (age, social-economic status, ethnic affiliation, somatic pathology, folate deficiency, pernicious habits etc.), placental (infarction, developmental anomaly, anomalous implantation, infectious placentitis), or fetal (constitutional peculiarities, gender, location, malformation, chromosomal aberrations, congenital anomalies, current infections following the pregnancy) factors perform the vital role. In 20% of

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Table 1. Demographic and Social-Economic Risk Factors Revealed in Studied Women (n = 142).

Risk factors	Main(n=92)	Control(n=50)	OR	95% CI	P
Age (>35)	11 (11.9%)	6 (12%)	0.99	0.31-3.27	1.000
Secondary education	20 (21.7%)	8 (16%)	1.45	0.54-3.98	.548
Housewife	42 (45.6%)	17 (34%)	1.63	0.75-3.55	.243
Civil servant	50 (54.4%)	29 (58%)	0.86	0.40-1.83	.809
Mental labor	47 (51.1%)	29 (58%)	0.75	0.36-1.60	.540
Physical labor	45 (48.9%)	18 (36%)	1.70	0.79-3.67	.193
Low financial income	21 (22.8%)	7 (14%)	1.81	0.66-5.16	.298
Low standards of living	22 (23.9%)	4 (8%)	3.61	1.08-13.31	.034
Single mother	5 (5.4%)	1 (2%)	2.81	0.30-66.70	.592
Tabaco consumption	27 (29.4%)	7 (14%)	2.55	0.95-7.10	.062
Chronic stress	65 (70.6%)	22 (44%)	3.06	1.41-6.69	.004
Sleeping disorder	68 (73.9%)	23 (46%)	3.33	1.51-7.34	.002
Poor nutrition	69 (75%)	22 (44%)	3.81	1.73-8.49	.001

cases the major cause of fetal developmental delay represents a genetic or infectious pathology.^{2,6,7}

It is also worth noting, that risk factors have not been entirely systemized, the frequency and share of each factor in formation of syndrome is unknown.⁸ The specific attention should be focused on mother's risk factor, whose negative impact accounts for the disorder of placental angiogenesis, feto—placental insufficiency (dysfunction of placenta), metabolic disorders in fetus and newborn babies.^{9,10} The identification of maternal risk factors is a cornerstone of successful solution to this problem.

The research aims at studying the mother's social-hygienic and medical-biological risk-factors determining their share and predictive value in forming fetal developmental delay.

Design of research

The hospital retrospective case-control study was conducted in a traditional design. The cohort of 92 mothers, whose pregnancy was completed by the birth of neonates suffering from intrauterine growth restriction, were involved in the case (main) group through applying the selection method.

The verification of syndrome of fetal developmental delay was based on the inconsistency of fetometrical data with the gestational age of fetus (less than 10th percentile after 18 weeks of pregnancy).

Criteria for involvement in the main group were as follows: reproductive age (from 16 up to 40); verified diagnosis of fetal developmental delay made in prenatal or postpartum period; single fetal pregnancy; informed patient's consent to conducting clinical research.

Criteria for exclusion from clinical research were as follows: multi fetal pregnancy; the pregnancy

achieved by assisted reproductive technologies; chronic somatic pathology; congenital anomalies in fetal growth.

The control group consisted of 50 pregnant women, whose pregnancy was developing physiologically and was completed by the birth of a healthy neonate, whose anthropometric indicators corresponded to their gestational age.

Risk factors were studied through investigating pregnant women by cross-sectional study (medical history) and standard questionnaire. There were studied a mother's demographic and social-economic indicators, obstetric anamnesis, extra genital and genital diseases, complications of pregnancy. The length of completing the questionnaire was 45 minutes on average.

The statistical analysis was conducted through using Microsoft Excel 2010 and SPSS/v15 software packages. In order to evaluate risk factors, odds ratio (OR) was studied on the basis of 95% confident interval (CI).

Findings

The cohort of 142 pregnant women of reproductive age were studied, 83 of them were Georgian (58,5%) and 59—of different nationalities (41,5%). The average age of participants was 27.1 ± 6.3 in the main and 27.2 ± 5.8 in control group. The majority of participants represented civil servants (main group—54.4%, and control group—58%). Low level of education (21.7%), financial income (23.9%) and low standards of living (23.7%) were more frequently encountered in the main group. Table 1 shows quantitative indicators of maternal demographic and social-economic risk factors and their relative risk.

Based on findings, more than 2 indicators of odds ratio were revealed among single (OR-2.18) and Tabaco consuming mothers. According to *P*-data, low standards

Table 2. Extra Genital Pathology Revealed in Studied Women t (n= 142).

Extra genital pathology	Main (n=92)		Control (n=50)		OR	95% CI	P
	ANP	%	ANP	%			
Obesity	46	50.0	16	32.0	2.13	0.97-4.66	.059
Diabetes	3	3.4	1	2.0	1.65	0.15-41.67	1.000
Liver pathology	18	19	5	10.0	1.53	0.69-7.28	.216
Gastroenterologic diseases	51	55.4	23	46.0	1.46	0.69-3.09	.369
Endocrine diseases	32	34.9	7	14.0	3.27	1.23-9.02	.014
Ischemic heart disease	30	32.6	5	10.0	4.35	1.45-13.92	.006
Arterial hypertension	54	58.7	9	18.0	6.47	2.63-16.29	.000
Iron deficiency anemia	74	80.4	25	50.0	4.11	1.80-9.42	.001
Chronic pathology of respiratory system	64	69.7	20	40.0	3.42	1.57-7.52	.002

Table 3. Genital Pathology Revealed in Studied Women.

Genital pathology	Main (n=92)		Control		OR	95% CI	P
	ANP	%	ANP	%			
Chronic inflammatory	48	52.2	20	40.0	1.63	0.76-3.49	.226
Inflammation of cervix	35	38.0	6	12.0	4.50	1.62-13.14	.003
Cervicitis	29	31.5	3	6.0	2.83	1.06-7.83	.036
Endometriosis	9	9.9	3	6.0	1.69	0.39-8.37	.646
Endometrial hyperplasia	7	7.6	2	4.0	1.97	0.35-14.36	.629
Ovarian cysts	16	17.4	4	8.0	2.42	0.69-9.17	.199
Ovarian chronic inflammation	37	40.2	6	12.0	4.93	1.78-14.37	.001
Cervical erosion	40	43.5	9	18.0	3.64	1.48-9.16	.004
Colpitis (vaginitis)	52	56.5	19	38.0	2.12	0.99-4.56	.053
Trichomoniasis	39	42.4	16	32.0	1.56	0.71-3.44	.302
Mycoplasmosis	13	14.1	6	12.0	1.20	0.39-3.86	.922
Chlamidiosis	39	42.4	11	22.0	2.60	1.12-6.19	.025

of living (OR-3.61, 95% CI 1.08-13.31, P -.034), chronic stress (OR-3.06, 95% CI 1.41-6.69, P -.004), sleeping disorder (OR-3.33, 95% CI 1.51-7.34, P -.002), and poor nutrition (OR-3.81, 95% CI 1.73-8.49, P -.001) proved to be statistically reliable.

It is worth noting, that regarding the coexisting extra genital diseases, obesity (50.0) and gastroenterologic diseases (55.4%) prevailed among the patients of main group, which 1.5 times exceeded the data of control group (32% and 46% respectively). See Table 2.

The high indicators of odds ratio were detected in case of existing endocrine pathology (OR-3.27, 95% CI -1.23-9.02, P -.014), ischemic heart disease (OR-4.35, 95% CI -1.45-13.92, P -.006), arterial hypertension (OR-6.47, 95% CI -2.63-16.29, P -.000), iron deficiency anemia (OR-4.11, 95% CI -1.80-9.42, P -.001) and chronic pathology of respiratory system (OR-3.42, 95% CI -1.57-7.52, P -.002). Anemia was represented by extremely high share (80.4%), which denoted the sharp decline in the process of erythropoiesis. Anemia and

iron deficiency in maternal and fetal organism cause the decline in ferment activation of respiratory system and even more strengthen placental insufficiency.^{1,11}

In terms of coexisting genital pathology special attention was focused on chronic inflammatory and parasitic diseases. The frequency of inflammatory processes of genital system was higher in case of fetal developmental delay (main group 52.2%, control group 40%). See Table 3.

The inflammation of cervix was detected 3 times more in the main group (38%) (OR-4.50, 95% CI -1.62-13.14, P -.003). Cervicitis (31.5%) (OR-2.83, 95% CI -1.06-7.83, P -.036), ovarian chronic inflammation (40.2%) (OR-4.93, 95% CI -1.78-14.37, P -.001) and cervical erosion (43.5%) (OR-3.64, 95% CI -1.48-9.16, P -.004) were represented by high share. According to researches, chronic genital inflammatory processes disturb a pregnant woman's ability of adaptation, cause metabolic disorders and prolong fetoplacental insufficiency.⁶

Table 4. The Predictive Value of Maternal Risk Factors.

Maternal risk factors	Main group (n=92)	Control group (n=50)	Predictive value positive (%)	Predictive value negative (%)
Low standards of living	22 (23.9%)	4 (8%)	84	72
Chronic stress	65 (70.6%)	22 (44%)	74	51
Sleeping disorders	68 (73.9%)	23 (46%)	74	52
Poor nutrition	69 (75%)	22 (44%)	75	52
Endocrine pathology	32 (34.9%)	7 (14.0%)	82	41
Ischemic heart disease	30 (32.6%)	5 (10.0%)	85	42
Arterial hypertension	54 (58.7%)	9 (18.0%)	51	44
Iron deficiency anemia	74 (80.4%)	25 (50.0%)	74	58
Pathology of respiratory system	64 (69.7%)	20 (40.0%)	76	51
Inflammation of cervix	35 (38.0%)	6 (12.0%)	85	43
Cervicitis	29 (31.5%)	3 (6.0%)	81	41
Ovarian chronic inflammation	37 (40.2%)	6 (12.0%)	86	44
Cervical erosion	40 (43.5%)	9 (18.0%)	81	45
Chlamydiosis	39 (42.4%)	11 (22.0%)	78	42
Vomiting during pregnancy	81 (88.0%)	24 (48%)	74	75
Risks to miscarriage	80 (86.9%)	19 (38%)	80	72
Preeclampsia	47 (51.1%)	4 (8%)	92	50
Low amniotic fluid	69 (75%)	8 (16%)	89	64

Among parasitic and infectious diseases the attention was focused on high frequency of trichomoniasis (42.4%) and clamidiosis (42.4%). In case of clamidiosis odds ratio was high as well (OR-2.60, 95% CI -1.12-6.19, P -0.025). Depending on the literary data, during pregnancy the activation of parasitic and infectious processes is linked to homeostatic changes of the organism and effects fetal organs as well as the systems of vital importance extremely negatively.¹²

In case of fetal developmental delay the study of obstetric anamnesis of pregnant women showed that the average indicator of recurrent pregnancy was 2.15 ± 1.75 , and the parity 1.49 ± 0.81 ; in the control group 2.6 ± 1.52 and 1.82 ± 1.11 respectively. Twenty-eight and three tenths percent of the main and 28.0% of control group took hormonal contraceptives. Dysmenorrhea was detected in 46.7% of the main group, whereas this indicator made 16% in the control group.

A number of cases of current complications following the pregnancy (27.2%) and labor (29.4%) were also detected in the anamnesis of pregnant women with fetal developmental delay (in the control group 20% and 16%). As regards the current complications following the pregnancy: in the main group there were surely encountered vomiting during pregnancy (88.0%) (OR-7.97, 95% CI -3.20-20.24, P -0.000), risks to miscarriage (loss of fetus) (86.9%) (OR-10.8, 95% CI -4.39-1.84, P -0.000), low amniotic fluid (69.6%) (OR-15.7, 95% CI -6.0-42.74, P -0.000) and preeclampsia (95.1%) (OR-12.01, 95% CI -3.72-42.92, P -0.000). Preeclampsia is the most frequent and greatest cause of forming the

placental blood circulation disorder and insufficiency that perform the significant role in formation of fetal developmental delay. As regards low amniotic fluid, according to the data of recent years, oligohydramnios is considered to be one of the earlier diagnostic criterion of fetal developmental delay.^{13,14}

Predictive value was determined for statistically-valid risk identified in the process of research. See Table 4.

The risk factors of high predictive value revealed in the process of research were as follows: low standards of living (84%), endocrine pathology (82%), ischemic heart disease (85%), inflammation of cervix (85%), cervicitis (98.1%), ovarian chronic inflammation (86%), and risks to miscarriage (80%). Preeclampsia (92%) and low amniotic fluid (89%) proved to be of particularly high value.

In conclusion, the complex study of mother's social-hygienic and medical-biological indicators was conducted in the process of research. There were detected statistically-valid risk factors having a high priority and predictive value, which can be identified in the pre-gravid phase. The considerable importance is attached to timely identification of these factors and introduction of individual measures of managing them so as to minimize their incidence and reduce negative impact on pregnant women and fetus.

Author Contributions

The research is done by Author and it was conducted in Georgian perinatal multiprofile centers.

Declaration of Conflicting Interests

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References

1. Кочерова ВВ, Щербак ВА. Задержка внутриутробного развития плода: факторы риска, диагностика, отдаленные последствия. *Российский педиатрический журнал*. 2015;18:36-42.
2. Летифов М, Прометной ДВ, Давидова НА, Рамазанова НВ. Задержка внутриутробного развития плода (факторы риска, ближайшие и отдаленные последствия). Обзор литературы. *Журнал "Практика педиатра"*; февраль, 2016:18-23.
3. Ernst SA, Brand T, Reeske A, Spallek J, Petersen K, Zeeb H. Care – related and maternal risk factors associated with the antenatal nondetection of intrauterine growth restriction: a case-control study from Bremen, Germany. *BioMed Res Int*. 2017;2017:Article ID 1746146.
4. Varvarigou AA. Intrauterine growth restriction as a potential risk factor for disease onset in adulthood. *J Pediatr Endocrinol Metab*. 2010;23:215-224.
5. Mendez-Figueroal H, Chauhan SP, Troungl VTT, Pedroza C. Morbidity and mortality with small for gestational age: secondary analysis of nine MFMU network studies. *Am J Obstetr Gynecol*. Published online August 17, 2016. doi:10.1055/s-0036-1586502
6. Гулиев НД, Гараева СЗ, Рагимова ШШ, Валиева ГМ. Антенатальные факторы риска задержки внутриутробного развития ребенка. *Российский вестник перинатологии и педиатрии*. 2015;5:51-53.
7. Ernst SA, Reeske S, Spallek J, Petersen K, Brand T, Zeeb H. Care – related factors associated with antepartal diagnosis of intrauterine growth restriction: a case-control study. *BMC Pregnancy Childbirth*. 2014;14:371.
8. Shrestha A. Analysis of frequency and risk factors for intrauterine growth restriction. *Int J Sci Rep*. 2018;4:11-14.
9. Anderson NH. Maternal and pathological pregnancy characteristics in customized birth weight centiles and identification of at-risk small-for-gestational-age infants: a retrospective cohort study. *BJOG*. 2012;119:848-856.
10. Sato Y, Benirschke K, Marutsuka K, Yano Y, Hatakeyama K, Iwakiri T, et al. Associations of intrauterine growth restriction with placental pathological factors, maternal factors and fetal factors; clinicopathological findings of 257 Japanese cases. *Histol Histopathol*. 2013;28:127-132.
11. Thekkadathu VCA. Maternal and placental risk factors associated with intrauterine growth restriction and perinatal outcomes. *J South Feder Obst Gynaecol*. 2015;7:176-181.
12. Manandhar T, Prashad B, Mahindra Nath pal. Risk factors for intrauterine growth restriction and its neonatal outcome. *Gynecol Obstet*. 2018;8:464.
13. Haşmaşanu MG, Bolboaca SD, Drugan TC, Matyas M, Zaharie GC. Parental factors associated with intrauterine growth restriction. *Srp Arh Celok Lek*. 2015;143:701-706.
14. Muniyar N, Kamble V, Kumar S. Pgencies – Feto-maternal outcome. *Gynecol Obstet (Sunnyvale)*. 2017