



## RISK FACTORS FOR CARDIOVASCULAR EVENTS IN NEWBORNS

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### ABSTRACT

Today some chronic, disabling pathological conditions in adults including cardiovascular diseases appear to be originated in the peri- and neonatal periods. Present study involved a questionnaire survey of 105 mothers in order to identify the most important environmental, heredity, maternal health factors and to study their impact on the development of cardiovascular system of the newborn. The questionnaire included 30 questions grouped into 5 main domains: 1) Family and genetic data on cardiac pathology, 2) the state of health of a pregnant woman, 3) environmental risk factors for congenital heart disease, 4) the nature of the course of pregnancy, 5) infectious risk factors. Totally 112 newborns of gestational age  $37.2 \pm 2.5$  weeks were examined for objective examination, who revealed symptoms indirectly indicating changes of the cardiovascular system (systolic murmur in auscultation, cardiac arrhythmia, perioral cyanosis), as well as children who were born with intrauterine growth retardation and "late premature". The research showed that 84.8% ( $p \leq 0.05$ ) of newborns were healthy and 15.2% had morphofunctional abnormalities of the cardiovascular system (delayed closure of the ductus arteriosus, patent foramen ovale, violation of the diastolic function of the heart ventricles, small anomalies of the heart development). Parental age over 30 years, severe somatic diseases in mothers and family history of cardiovascular diseases were found to be the most significant risk factors for cardiac diseases in infants. Prevention of preterm labor and diseases in infants requires measures to increase women's motivation to take proper care of their own health.

**KEYWORDS:** newborns, risk factors, cardiovascular disorders.

### INTRODUCTION

Contemporary scientific biological achievements at the end of 20<sup>th</sup> century and the beginning of 21<sup>st</sup> century gave rise to a trend towards the reduction in the intensity of population growth, accompanied by a decrease in maternal, perinatal, infant and child mortality [Kostin I, 2012]. Today some chronic, disabling pathological conditions in adults including cardiovascular diseases appear to be originated in the peri- and neonatal periods [Sun C et al., 2013; Lavrenuk I et al., 2014; Palinski W, 2014]. There are many risk factors for cardiovascular diseases triggering concern; in addition, there is a lack of prophylactic measures for their prevention. Apart from promoting healthy lifestyle among population it is necessary to provide individual

preventive measures [Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents, National Heart, Lung, and Blood Institute, 2011; Marco L et al., 2012; Senatorova G et al., 2015; Piepoli M et al., 2016] starting with neonatal period. Thus, early diagnosis and timely correction of the identified cardiovascular impairments in children from the beginning of neonatal period may be a factor contributing to the decrease in incidence of cardiovascular events in children and adults.

Present study aimed to identify significant environmental, heredity and maternal health factors and to study their impact on the development of cardiovascular system in infants by a prospective survey, followed by the assessment and determination of measures to improve health care for newborns with cardiovascular disorders and their prevention.

### MATERIAL AND METHODS

The study design implied elaboration of a questionnaire and a survey of women with a specially

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adapted questionnaire followed by statistical processing of obtained results. The adapted version was elaborated based on Preparticipation Health Screening and Risk Stratification questionnaire [Thompson W et al., 2010], which was the prototype of the designed questionnaire. The study involved all infants with symptoms indirectly indicating changes in the cardiovascular system (systolic murmur in auscultation, arrhythmic cardiac activity, perioral cyanosis) detected by physical examination, as well as infants born with intrauterine growth retardation and “late preterm” newborns. Data on health status of newborns were obtained by the assessment of medical records, clinical examination and Doppler echocardiography. The questionnaire included 30 questions grouped into 5 main domains: 1) Family and genetic data on cardiac pathology, 2) the state of health of a pregnant woman, 3) environmental risk factors for congenital heart disease, 4) the nature of the course of pregnancy, 5) infectious risk factors. The investigation was approved by Institutional Bioethics Committee and conforms to the principles outlined in the Declaration of Helsinki (Br Med J, 1964; p. 177) with subsequent additions. Statistical analysis of the results allowed us to create a database with estimation of the number of findings for each response; the study also implied a description of quantitative and qualitative indices. Intra-group changes were assessed by frequency tables; dependence of some answers (phenomena) on the other ones was evaluated by crosstabulation of STATISTICA 7 software.

#### RESULTS AND DISCUSSION

The study involved a questionnaire survey of 105 mothers and examination of 112 infants of gestational age  $37.2 \pm 2.5$  weeks. Distribution of interviewed women by age was as follows: 7 women (6.7%) – under 20 years, 68 women (64.8%,  $p \leq 0.05$ ) – at the age of 21-30 years, 30 women (28.6%) – over 31 years. The mean age of parturient women was  $27.9 \pm 4.5$  years. The mean age of fathers comprised  $31.1 \pm 5.4$  years, with 51.0% ( $p \leq 0.05$ ) of the men over 32 years.

Among the surveyed contingent, mothers of newborn boys (53.4%) predominated. The survey showed that 48.2% of the infants were born from the first pregnancy, 19.6% from the second and 32.2% from the third and subsequent pregnancies.

More than half (56.2%,  $p \leq 0.05$ ) of the newborns were born from the first labor, 31.2% from the second, 15.6% from the third, 3% of the children from the fourth. As for prenatal care, 63.8% ( $p \leq 0.05$ ) of women visited prenatal clinic at the term of gestation less than 12 weeks, 35.2% of women at the term less than 22 weeks and one woman – at the term more than 30 weeks.

High-risk pregnancy with preeclampsia during I and/or II half of pregnancy developed in 45.7% of women; 25.7% of respondents had high blood pressure above the 90<sup>th</sup> percentile. The threat of preterm labor was registered in 32.4% of respondents, from whom 26.5% in the gestational period of 6-12 weeks and 73.5% ( $p \leq 0.05$ ) in the period of 22-34 weeks of gestation. Various chronic diseases (hypertension, vegetative-vascular dysfunction, chronic pyelonephritis, obesity, gastric ulcer or duodenal ulcer, primary hypothyroidism (medication compensated), varicose veins, epilepsy, malformation of the urinary and biliary tracts) were observed in 45.7% of mothers.

Compromised history of cardiovascular diseases was detected in 33.3% of surveyed mothers, from whom 5 women had parents or siblings with congenital heart diseases and cases of sudden death in two families. Family members of 18.1% interviewed women were registered in a cardiologic dispensary. Cardiovascular abnormalities (hypertension, vegetative dysfunction, secondary cardiomyopathy, etc.) were detected in 20.9% of the mothers, 2 women were diagnosed with congenital heart diseases (atrial septal defect, post-correction condition, and non-critical pulmonary stenosis). The questionnaire survey showed that 38.1% of respondents had unpleasant sensations in the region of heart after exercise and/or stress, which spontaneously disappeared in 15.2%, whereas 22.9% had to take sedatives.

From 62.9% ( $p \leq 0.05$ ) women, examined for the presence of infections during pregnancy, 17.1% were found to have herpes, cytomegalovirus, chlamydia infections or toxoplasmosis. Acute respiratory infection was diagnosed during the second trimester of pregnancy in 20.9% of mothers. Occupational hazard was reported by 6.7% of women who had worked with paints and varnishes, household chemicals or experienced vibration during their work.

Scientific evidence suggests that inhaling car-

bon monoxide/tobacco smoking reduces the weight of the fetus and can cause neuropsychiatric disorders in children of smoking parents [Gorbach T et al., 2016; Holbrook B, 2016]. As for smoking, 15.2% of women smoked in the past, and 17.1% of the respondents quit smoking before the planned pregnancy. The survey showed that other family members of half of the non-smoking and non-drinking women had these bad habits.

The study also revealed such a disappointing and distressing fact as the failure to comply with the doctor's recommendations (every third woman, i.e. 27.6%), which indicates a low threshold of expectant mothers' concern for both their own and the child's health.

Furthermore, 89.5% ( $p \leq 0.05$ ) of women estimated their health during pregnancy as good, 9.5% as satisfactory and one woman as poor.

Most of the children were born in a satisfactory condition, from them 86.7% ( $p \leq 0.05$ ) had Apgar score of 8-10 points, 9.5% of 7-8 points, and only 3.8% – 4-6 points. Besides, 84.8% ( $p \leq 0.05$ ) of the infants were healthy, 15.2% were found to have morphofunctional abnormalities (delayed closure of the ductus arteriosus, broad patent foramen ovale, which over time required differential diagnosis with secondary atrial septal defect, impairment of diastolic function of heart ventricles, mild anomalies of heart development). One newborn was diagnosed with congenital heart disease (ventricular septal defect).

Crosstabulation allowed us to determine statistically significant dependencies of some responses from others. Thus, pregnant women with cardiovascular diseases often had a compromised family history (heart diseases in the family), although

they considered their physical activity to be sufficient and did not have any excessive weight or obesity. The study determined a relationship between a discomfort and pain in the region of the heart, alcohol consumption and the presence of chronic foci of infection. It also confirmed a relationship between alcohol consumption before pregnancy and a sudden death of relatives in failure to comply with recommendations prescribed by the doctor, who had managed the pregnant during her gestation period.

It is of interest to note a dependency, indicating that women with chronic infection foci also did not carry out the doctor's recommendation properly. It brings up to date the issue of providing advisory trainings, aimed at maintaining proper pregnant women's care for their own health and the health of the unborn child.

Thus, detection of morphological and functional disorders of the cardiovascular system in neonates necessitates the extension of the search for responsive risk factors for cardiac diseases in newborns, beginning with the neonatal period.

#### CONCLUSION

Conducted medico-sociological survey revealed "hidden" factors that can affect not only the reproductive health of women, but also the state of the cardiovascular system in their children.

The most significant risk factors for cardiac diseases in infants include parental age over 30 years, severe somatic diseases in mothers, compromised family history of cardiologic disorders.

Prevention of preterm labor and diseases in infants requires measures aimed to increase women's motivation to take proper care for their own health.

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