MEDICAL SCIENCES

ADAPTATION POTENTIAL OF THE CARDIOVASCULAR SYSTEM IN CHILDREN RESIDING NEAR THE CHORNOBYL EXCLUSION ZONE

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Populations residing near the Chornobyl Exclusion Zone (ChEZ) have been exposed to radiation risks for many years.

This is due to the contamination of the local soil with long-lived radioactive elements ^{137}Cs and ^{90}Sr, which enter the bodies of local residents through food chains [1, pp. 120–121; 2, p. 350].

The negative impact of incorporated ^{137}Cs radionuclides on vital systems of the child's body, particularly the cardiovascular system, is well documented [3, p. 12].

In this context, an energy deficit arises within cardiomyocytes and the structures of the heart's conduction system, leading to cardiac rhythm disturbances [3, p. 15].

During the European Commission's socio-medical project "Health and Ecological Programmes around the Chernobyl Exclusion Zone: Development, training and coordination of health-related projects" implemented in Ukraine between 2013 and 2017 examinations of the child population in the Ivankivsky and Polessky districts revealed that serum aspartate aminotransferase (AST) levels exceeded reference values in 37.5 % of cases, reflecting a decline in the energy potential of cardiac cells [1, p. 28].

A direct correlation between the specific activity of ^{137}Cs in the body and serum AST activity indicates the negative impact of this radionuclide on cardiomyocyte mitochondria [1, p. 31].

Studies have revealed transient hyperhomocysteinemia in a large number of children, indicating both a disruption of mitochondrial metabolism and the activation of processes aimed at restoring the body's physiological functions [4, p. 258].

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Thus, the survival and development of a child's body under conditions of radiation exposure depend on the state of its adaptive mechanisms.

In this context, data regarding the age-related dynamics of the cardiovascular system's adaptive capabilities in children living near the ChEZ are of significant importance.

The present study assessed the adaptive potential (AP) of the cardiovascular system on two occasions, separated by a one-year interval, in 433 children aged 6–17 years residing in settlements within the Ivankivsky district.

AP is an estimated indicator calculated using R. M. Baevsky's formula (1979), which incorporates systolic and diastolic blood pressure, the child's age (in years), body mass and height, and a constant coefficient of 0.27.

AP values (arbitrary units) were assessed using a scale modified by L. V. Kvashnina for children aged 6–17 years, taking gender-specific differences into account [5, pp. 5–6].

The studies revealed a significant reduction in the adaptive capacity of the cardiovascular system among children living near the ChEZ.

Only one-third of the children residing in the settlements of the Ivankivsky district demonstrated a satisfactory level of adaptive potential (Table).

At the same time, there were no statistically significant differences between the values of the corresponding indicators recorded during the first and second examinations.

Table

Distribution of children according to AP values at the first and second examinations

Examination	Subgroups with different index levels AP							
	A		B		C		D	
	n	%	n	%	n	%	n	%
First	128	29.56	132	30.49	105	24.25	68	15.70
Second	144	33.26	127	29.33	103	23.79	59	13.63

Note. A – satisfactory adaptation; B – adaptation stress; C – unsatisfactory adaptation; D – disruption of adaptation mechanisms.

AP values remained within the estimated range in 196 children (45.27 %); an increase in AP values (indicating a deterioration in the body's adaptive capabilities) was observed in 106 children (24.48 %); and a decrease in AP values (indicating an improvement in adaptive capabilities) was observed in 131 children (30.25 %).

Upon follow-up examination, no increase in the AP index above 1.90, which would indicate a deterioration in adaptive capabilities, was recorded in 82 cases

(64.06 %) within the subgroup of children with satisfactory adaptation (n = 128).

Similarly, no decrease in the AP index below 2.41, indicating an improvement in adaptive capabilities, was recorded in 31 out of 68 cases (45.59 %) within the subgroup of children experiencing a breakdown of adaptive mechanisms.

Thus, two-thirds of the children who were born and resided near the ChEZ at the time of the study exhibited unsatisfactory indicators regarding the adaptive capabilities of their cardiovascular systems.

In more than 45 % of cases, the AP index showed no significant change one year after the initial examination. This was particularly true for children at the extreme ends of the AP spectrum: those with satisfactory adaptation and those experiencing a breakdown of adaptive mechanisms.

The stability of AP values during postnatal development in a large number of children highlights the critical role of the prenatal period in shaping the regulatory mechanisms that govern the functioning of the body's vital systems.

Consequently, the reduced cardiovascular adaptive capabilities observed in children of the "second Chornobyl generation" living near the ChEZ may be linked to radiation exposure during prenatal and early postnatal development.

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