

CLINICAL EFFECTS IN CHILDREN IRRADIATED PRENATALLY: 11 YEAR SURVEY RESULTS

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ABSTRACT

The 11 years-long survey results indicated the amount of children increase with discordant development signs, thyroid structure and function disorders both with that of somatic status. Majority of blood and immune system quality and quantity parameters deviations been present during the "acute iodine period" among children exposed to acute irradiation gradually reached the control level. The hemopoetic and immunocompetent system function substantial deviations are continued being registered among children born in zone of radionuclide contamination.

INTRODUCTION

The high radiosensitivity is characteristic for organism on stage of development and differentiation. Therefore children represent themselves the critical population group mostly affected after radiation accidents especially in case of ionising radiation effect during antenatal ontogenic period [1 - 3].

MATERIALS AND METHODS

The 1104 children born in 1986 were surveyed during 11 years of post-accidental period. The Ist study group was presented with children born from women pregnant at the moment of Accident and evacuated from town Pripjat - 340 kids; IInd - children born and resident in radionuclide contamination zone - 169 persons; IIIrd - control group - 595 persons respectively. The fetal thyroid irradiation doses consisted 0.1 - 334.0 sZv, total irradiation doses in Ist study group - 10 - 376 mZv, in IInd - 4.7 - 33 mZv respectively. The thymus and red bone marrow irradiation dose values in Ist study group were 10.0 - 300.0 mZv, in IInd - 4.2 - 25.9 mZv and 4.7 - 35.5 mZv respectively.

The clinical, hemetological studies were carried out, the neutrophyles functional properties were tested with alkaline (AlPh) and acid (AcPh) phosphatases, myeloperoxidase (MP), NADH₂ and NADPH₂ dehydrogenases (DG) activities evaluation; lipids (LP) and glycogene (Gl) content [4], phagocytosis percentage (PhP), phagocytic index (PhI) assessment; NBT-test parameters in spontaneous and stimulated variations (percent of formazane-positive cells - PFPC, average cytochemical index of tetrasolreducing activity - ACITA) [5] estimation. The blood cells ultrastructure and superficial architectonics were estimated with transmissional (TEM) and scanning (SEM) electrone microscopy. The immunocompetent cells subpopulations content was studied on lazer flow cell sorter FACStar PLUS ("BECTON DICKINSON" Co.) with LT - series monoclonal antibodies application (produced in Moscow Institute for Immunology). The serum immunoglobulines A, M, G content was assaied with

immunodiffusion in agar gel method. The thyroid structure evaluation was held with echo camera "Aloka-SSD-500". The hormonal studies were completed via immunofluorescent method on DELFIA unit ("Wallac" Co.). The mathmethods complex was applicated for children health deterioration risk estimation.

RESULTS AND DISCUSSION

According to the received data, the average physical development parameters in newborns from Ist and IInd study groups corresponded to control. The personal parameters analysis indicated the more frequent (7.6%) than in control (2.9%) birth of children with "low for term" body mass in IInd group ($p < 0.01$). No cases were registered in newborns of head circumference lower than normal age values. In children from IInd study group the lower body mass was registered at age of 1 year. The amount of children increase with discordant physical development was fixed in further years, especially in IInd study group (Table I) both with that of thyroid goiter of IB - II degree (Table II).

Table I. - Children with discordant physical development quantity in post - accidental period dynamics (per cent).

Study group	Years of survey				
	1989	1991	1993	1995	1997
I	6,2	8,3	12,7	16,9	27,4
II	9,1	13,2	19,8	27,6	49,3
III	4,7	6,9	11,1	15,1	17,1

Table II. - Thyroid gioter frequency in post-accident period dynamics among children irradiated in utero (per cent).

Goiter degrel	Ist group					IInd group					IIIRD group degree				
	1989	1991	1993	1995	1997	1989	1991	1993	1995	1997	1989	1991	1993	1995	1997
0	72.3	60.7	11.4	10.2	40,3	87.0	57.7	16.1	15.1	25,9	92.6	87.0	83.6	54.5	71,7
I-A	26.8	37.9	80.4	75.2	38,5	12.5	39.7	72.1	70.2	47,2	7.4	13.0	13.2	34.0	11,2
I-B	0.9	1.4	8.2	14.6	20,3	0.5	2.6	11.8	14.7	25,4	0.0	0.0	3.2	11.5	17,1
II	0.0	0.0	0.0	0.0	0,9	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0,0

Thyroid structure irregularity during year 1989 studies was revealed in 51 % of children of Ist, in 41 % of IInd and in 19 % of control group respectively; that in 1997 consisted 37 %, 43 % and 21 % respectively. Cyst and nodular degeneration of thyroid tissue in 1997 was registered in 0.8 % of Ist and in 1.7 % of IInd study groups, no cases were fixed in control. No clinical signes of hypothyroidism were detected. The hyperthyroidism of mild degree was registered in 1997 among 0.2 % of children from IInd study group, autoimmune thyroiditis - in 1.2 % among children from Ist, in 1.8 % among children from IInd and in 0.2 % in control group respectively. The THS deviations from normal age values were registered in 2.4 - 5.1 % among Ist and IInd study groups; no deviations were registered in control.

The lower compared to control hemoglobine, WBC and platelets content was proprial to the children irradiated in utero during the early post-accidental period. The leucogram deviations were more frequent too. Those biases normalised in Ist study group at the age of 9 - 10 years old, in IInd one - still remained.

The blood cell ultrastructure estimation indicated the decreased volume cells presence among RBC with cytoplasmic gemmations of "apoptose bodies" creations - type, membranes focal loosening or condensing. The WBC content with functional activity morphological signes was increasing. The number of cells with peculiar nuclei forms, perinuclear space

dilatation, increased vacuolization and membranes microclazmatosis increased too. The mitochondria with enlightened matrix and partial crists desorganisation were registered more often. The "active" neutrophyles quantity increased. The autophagocytosis signs were revealed with cytoplasmic pieces registration in phagocytic vacuoles. The described disorders involuted in dynamics but not disappeared totally. The blood cells superficial architectonics changed substantially. The discocytes number was decreased to 62.5 - 59.8 % with transition, pre-hemolytic and degeneration-changed forms number synchronous increase. The amount of lymphocytes with relatively plain and villial surface decreased and increased with that of complicated surface type.

The neutrophyles metabolism among children from both main study groups in 1988 - 1989 was characterised with activation of AIP (127.5 ± 6.40 ut., in control - 79.08 ± 3.63 ut., $p < 0.001$); AcP (156.37 ± 5.92 ut., in control - 88.08 ± 3.45 ut., $p < 0.001$); NADH₂-DG (9.47 ± 1.81 gr./cell, in control - 4.83 ± 0.27 gr./cell, $p < 0.01$) and NADPH₂-DG (3.38 ± 0.47 gr./cell, in control - 1.93 ± 0.11 gr./cell $p < 0.001$); LP content increase (276.44 ± 7.71 ut., in control - 240.17 ± 6.48 ut., $p < 0.001$) and GI increase (274.00 ± 4.68 ut., in control - 249.75 ± 2.30 ut., $p < 0.05$). In further years the parameters graduent decrease was revealed, in Ist study group control values were reached up to 1995. In children of IInd group the intracellular enzymes, energetic and plastic substances depot exhaustion was observed. The neutrophyles function instability occured to be revealed on that background.

The immunologic parameters deviations in both Ist and IInd main study groups were of simmlar tendency and presented mainly with T-branch supression, immunoregulatory subpopulations disbalance and disimmunoglobulinemia. The personal parameters were rather variable with high frequency of deviations over the physiologic range. The three types were picked out from all the deviations variability. The first one was characteristic with CD8+ decrease, CD16+ and CD72+ - cells, immunoregulatory index increase, elevated Ig G and Ig M content (activational type). That one was present in 18.9 % of all children and manifestated with allergy syndrome. The second type was peculiar with CD3+, CD4+, CD16+, CD72+ - cells, Ig G and Ig A content decrease. This one was registered in 17.4 % of children and was presented with immunologic insufficiency infectional syndrome. The third type was characteristic with various combinations of immunologic parameters deviations without precisely describable clinical pattern. This undifferentiated type of immunologic disorders took place in 19.8 % of cases. The CD3+, CD4+ and CD8+ - cells content in children from Ist group turned to control values up to years 1995 - 1997, but the CD4+/CD8+ ratio remained more high ($p < 0.05$). No real positive dynamics was revealed in IInd study group. The immunologic status more severe disorders were present in children irradiated during first 15 weeks of gestation.

The mathanalysis indicated the more intensive increase of children with chronic pathology quota among irradiated in utero (Fig.1). The most sharp dynamics was in kids exposed in early gestation terms (Fig.2). The confidential dependence was fixed between health status, total irradiation dose, thymus, red bone marrow irradiation doses and some studied parameters with multiple correlation indices of 0.5754 - 0.8463. The health deterioration risk most informative criterions were: average absorbed dose ($\beta = 0.058$), thymus ($\beta = 0.031$) and red bone marrow average equivalent doses ($\beta = 0.047$); RBC content ($\beta = 0.027$); neutrophyles to lymphocytes ratio ($\beta = 0.031$); NADPH₂-DG activity ($\beta = -0.018$), PhI ($\beta = -0.035$); PFPC ($\beta = 0.011$); ACITA ($\beta = -0.028$); Ig A content ($\beta = -0.046$) and Ig M content ($\beta = 0.046$); immunoregulatory index ($\beta = 0.037$). The group health deterioration risk in children irradiated in utero consisted 1.63 - 2.94, with 0.85 - 1.13 value in control.

The integral index reflecting unfavourable biases as the result of Chernobyl accident radiation and non-radiation factors effection during ontogenesis antenatal period is presented with practically healthy children quota reduction among population from 35.7 % in 1987 to 5.0 % in 1996.

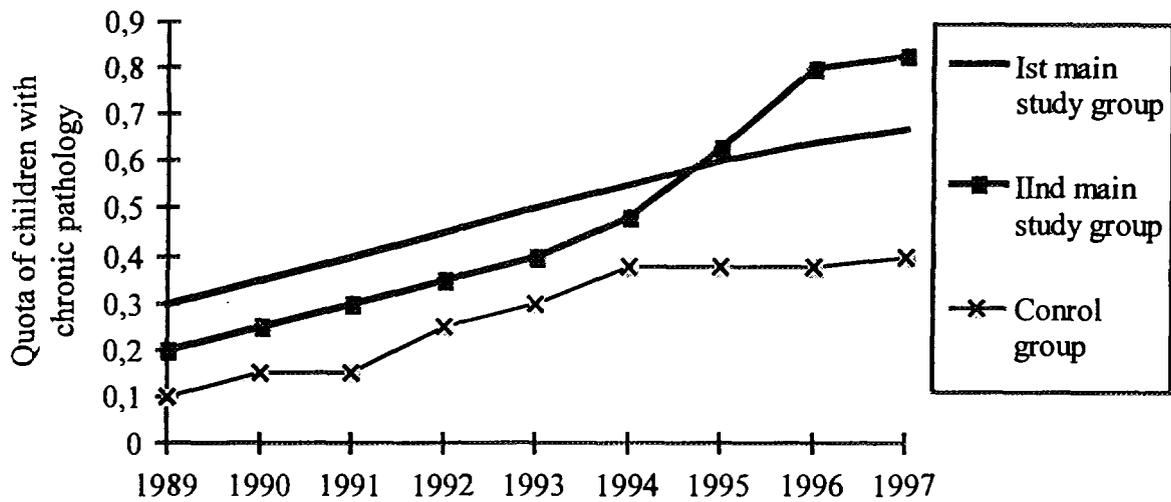


Fig.1. Quota of children with chronic pathology in dynamics after Chernobyl NPP accident

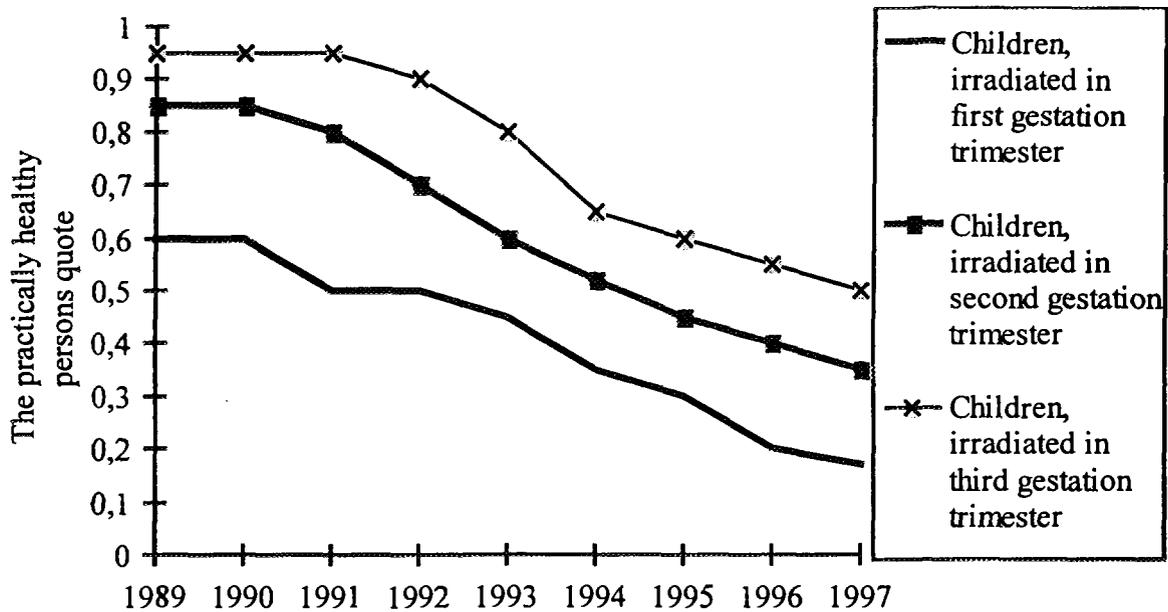


Fig.2 . Quota of healthy children in dynamics after Chernobyl NPP accident depending on various gestation term

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