

SEVERE OXIDATIVE STRESS AS POSSIBLE EVIDENCE OF REMOTE CONSEQUENCE OF RADIATION INJURY

A. Chumak, S. Alekhina, A. Kubashko, L. Ovsyannikova

SI «National Research Center for Radiation Medicine», NAMS of Ukraine, Kyiv

Results of over thirty-years health monitoring of clean-up workers exposed in wide range dose in results of eliminations consequences after Chernobyl NPP blast in 1986 is evidence of presence pathobiochemical persisting conditions resulting in development of chronic somatic diseases with plural comorbidities lead to premature aging, decrease life span and its quality. Oxidative stress (OS), sustained unrepaired DNA radiation induced damage, is a primary promoter of redox-sensitive signaling pathways and protein metabolism disorders attributed to morphofunctional changes realizing into clinical manifestations of chronic pathology. Thus, investigation of OS markers level in irradiated persons in dose in wide range allows understand character of biochemical changes in depends on absorbed dose in remote period.

44 clean-up workers of Chernobyl accident (all men) in age 62.5 ± 8.5 years ($M \pm SD$) with documented irradiation dose (D) of external exposure in range 1.12 ± 0.94 Gy ($M \pm SD$) in 1986–1988 were examined in remote period (2015-2016). 17 examinees underwent acute radiation syndrome (ARS) 0-3 degree: 7 from them had ARS 0 degree with D in range 1.71 ± 0.12 Gy (without bone marrow syndrome), 6 - ARS 1 degree (1.75 ± 0.38 Gy), 5 - ARS 2 degree (2.83 ± 0.61 Gy), 1 had ARS 3 degree with D 6.00 Gy. Other 25 examinees were exposed in D within 0.38 ± 0.36 Gy. 21 healthy men in appropriate age, without radiation anamnesis were recruited in control group. All patients had chronic comorbid pathology of digestive, cardiovascular and nervous systems without tumorigenesis.

The biochemical markers of lipid and protein oxidative degradation – lipids and proteins with carbonyl groups and antioxidant system (AOS) in erythrocytes – superoxidodismutase (*Zn/CuSOD*), catalase (E-CAT) activity, concentration of ceruloplasmin (CP), reduced glutathione (GSH) and total SH-groups in peripheral blood were tested. It was also calculated integral factor of antioxidant state (F_{AOS}) for assessment of pro- and antioxidant balance disturbance.

Obtained data shown that lipids and proteins level with carbonyl groups in irradiated examinees were higher in 1.62 times ($p=0.001$) and in 2.94 times ($p=0.002$) on a ground decreasing level of total SH-groups in 0.78 times ($p=0.023$) and CP in 0.78 times ($p=0.014$) according to control group. Integral F_{AOS} level was decreased in 1.24 times ($p=0.021$) in patients with ARS 0, and with increasing D it level was dropped down up to 3.60 times in patient with ARS 3 degree. The activity of *Zn/CuSOD* increased in 1.13 times ($p=0.040$) in compare to it activity in control group and was found that in patients, who underwent ARS 1 degree and was decreasing lower with ARS degree. In patient with ARS 3 irradiated patient in the highest dose - 6.00 Gy its activity was in 1.87 times lower toward control. CP level was lowest in exposed patients with absorbed $D < 1.0$ Gy - 176.21 ± 90.0 mg/l verse 272.91 ± 62.92 mg/l in control group. But it was increasing in examinees with $D > 1.0$ Gy that was confirmed by strong correlation between CP concentration and absorbed D – $r_p = 0.546$ ($p=0.000$) on a ground found correlation between D and E-CAT activity - $r_p = -0.451$ ($p=0.001$) and level of F_{AOS} - $r_p = -0.315$ ($p=0.026$) in all irradiated patients in the remote period after exposure that could be considered as severe OS.

Thus, obtained data points to association OS with factors of Chernobyl accident that aggravated by environment conditions and age changes in clean-up worker in remote period after exposure that could be considered as remote radiation effects contributing into development a multiple organs and system work failure resulting in manifestation chronic multimorbid pathology.