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COHORT STUDY OF HEALTH EFFECTS IN THE RESIDENTS EXPOSED TO IONIZING RADIATION – PROSPECTIVE

Since World War II more than 2,000 nuclear explosion tests have been conducted around the world of which the former Soviet Union conducted more than 700. The Soviet nuclear tests began in the Semipalatinsk Test Site (STS) in current Kazakhstan. The test site covers an area of 18,500 km^2 and is named after the city of Semipalatinsk, which is located approximately 150 km east of the test site. A total of 456 nuclear tests were conducted at the site during 40 years from 1949 to 1989. During 1949 to 1962 a total of 118 nuclear tests were conducted above ground and in the atmosphere, while 338 tests during 1961 to 1989 were conducted underground in boreholes and tunnels (Lukashenko SN (ed.), 2011). It is considered that 13 of the underground tests caused a radioactive release to the atmosphere. These releases, along with releases from the testing in 1949-1962, caused radioactive plumes that affected people and territories adjacent to the site, in particular the former Semipalatinsk oblast (region) (REA, 2010).

The health effects of exposures to fallout from Soviet nuclear weapons testing for the residents living near by the Semipalatinsk nuclear test site in Kazakhstan have not yet been investigated to their full extent. The historical cohort was originally set up by the local research institution “Dispensary No. 4” which was later succeeded by the Research Institute for Radiation Medicine and Ecology, Kazakhstan. The historical cohort included residents from ten highly exposed and six control settlements, for comparison. The cohort’s exposed group contains 9,850 permanent residents of the exposed settlements, all born before 1 June 1961. The comparison group includes 9,604 inhabitants, also born before 1 June 1961 and frequency-matched to the exposed group by age and gender. This cohort was finalized and quality assurance measures were taken within an EC funded INCO-COPERNICUS project.

The total radiation doses consisted of externaland internal doses. The external dose was calculated consideringexposure due to the radioactive cloud and fallout deposition. Dose estimations were based on the distance from the epicenter, exposurerates, yield, altitude of detonation above ground, and wind velocityduring and after the nuclear tests (B. I. Gusev). The internal dose was estimated forradioiodine isotopes, 137Cs and 90Sr, which had been measured in soilsamples of 1963. Cumulative average equivalent dose estimates werederived by summation of average equivalent dose estimates fromseveral consecutive nuclear test exposures for that settlement (K. N. Apsalikov). Fourof the atmospheric tests conducted between 29 August 1949 and 24 August 1956 accounted for more than 95% of the estimatedcumulative dose, 90% of which was accumulated within the firstyear of exposure (K. Gordeev).

The most recent analysis was published in 2011 where the relationship between mortality from cardiovascular diseases and radiation exposure from the fall-out was assessed (Grosche B. *et al,* 2011). The dosimetric approach for this study was developed by the US National Cancer Institute and the whole body external dose for the cohort members ranged from 0 to 0.63 Gy. The study concluded that there was no detectable risk of radiation related mortality from cardiovascular diseases in this cohort. Nonetheless, there was weak evidence that the point estimate for the radiation related risk might increase with increasing time since exposure. It is necessary to perform the prospective follow-up for various long term health effects from chronic exposure to low and moderate doses.

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CHRONIC MYOCARDIAL ISCHEMIA AS AN UNDESIRED SIDE EFFECT OF MEDIASTINAL IRRADIATION INJURY MOLECULAR PATHWAYS AND POSSIBILITIES OF PREVENTION

Chronic ischemic injury of the myocardium is increasingly recognized as an undesired side effect of radiation of cardiovascular system after mediastinal radiation therapy for malignancies.

The study concentrates on pathology of radiation-induced cardiovascular toxicity and on prevention of injury of healthy tissues in areas at risk. Irradiation of the heart with a single dose of 30 Gy delivered to the heart region was performed on male Wistar rats.

Adverse effect of ionizing radiation is mostly mediated by reactive oxygen and nitrogen species, which deplete antioxidant stores. Radiation damage of cardiovascular system shows that endothelial cells are the most radiation sensitive part of vasculature. Microvascular injury leads to myocardial ischemia.

Chronic myocardial underperfusion results in pathophysiological reaction connected with protective mechanism. Myocytes adjust its contraction function which is