ANALYSIS OF EMERGENCY RESPONSE AFTER THE CHERNOBYL ACCIDENT IN BELARUS: OBSERVED AND PREVENTED MEDICAL CONSEQUENCES, LESSONS LEARNED

E. Buglova, J. Kenigsberg
Research Clinical Institute of Radiation Medicine and Endocrinology
Masherov ave.,23 Minsk 220600, Belarus, e-mail: dcc@belamir1.belpak.minsk.by

ABSTRACT

The Chernobyl accident is one of the most dramatic reactor accidents, that affected several countries and millions people. Belarus is one of the most contaminated Republic due to this accident. The consequences of the Chernobyl accident affected all aspects of life, including social, economic and political, in all regions of the Republic. 23% of the entire area of Belarus was contaminated with radionuclides. To protect population of Belarus after the accident different types of protective actions were performed during all phases, based on various temporary dose limits. The analysis of conducted protective actions and lessons obtained during the emergency response will helps different countries to create system of effective emergency response and to improve existed system of preparedness.

Key words: Chernobyl accident, intervention, response

INTRODUCTION

The Chernobyl accident is one of the most powerful disaster of its kind anywhere on the planet. More than ten years the population of the Republic of Belarus has been living under post-accident conditions caused by the explosion of the Chernobyl nuclear power plant on 26 of April 1986. The consequences of the Chernobyl accident affected all aspects of life, including social, economic and political, in all regions of the Republic. 23% of the entire area of Belarus was contaminated with radionuclides [1].

Radiation protection of population of the Republic of Belarus following the Chernobyl accident is one of the crucial problems aimed to reduce the exposure doses and risk of radiation induced effects. Different protective measures with various level of effectiveness have been undertaken during all phases of the accident.

MATERIALS AND METHODS OF ANALYSIS

Different protective actions that were conducted during all phases of the accident in Belarus were analyzed considering levels of averted doses for some categories of population, prevented and observed medical effects, background for decision making. Prognosis of stochastic consequences of exposure was carried out based on level of received doses for whole body and thyroid [2,3], recent demographical data for Belarusian population, recommended risk coefficients [4,5,6].

RESULTS AND DISCUSSION

Conducting of countermeasures during the acute phase of the accident was aimed at prevention of deterministic effects of ionizing radiation to the human body.

The highest doses were determined for clean-up workers who worked near station in 1986-1987 years. 30% of them received doses of total exposure in the range 50-100 mSv, 47% - doses 100-250 mSv and 7.3% - more than 250 mSv [7]. Regarding stochastic effects, among clean-up workers who live in Belarus it is expected up to 200 cases of fatal and about 40 non-fatal cancer cases during life time.

The main protective actions that was carried out during the acute phase was evacuation of population from the regions located close to the station. Making of decision at that time was based on operated “Criteria
During the acute phase of the accident thyroid blocking by stable iodine was also performed. It was particularly important because I-131 was one of the most significant source of dose formation during the first months following the accident. The criteria for thyroid blocking was dose levels of intervention expressed in predicted adsorbed doses to thyroid for the first week after the accident of 300-2500 mGy. Mentioned criteria are upper than recommended international levels of intervention (100 mGy), but their utilization could be acceptable in the case of in-time performance. Performance of thyroid blocking in Belarus was delayed and non-effective. According to the information of the USSR Ministry of Health stable iodine was administrated to 43,000 of Belarusian children. Distribution of stable iodine to the main groups of population exposed to radiation was started during the first 3-6 days after the accident. According to the experts estimation only 20% of distributed several millions of tablets have been used for thyroid protection. As a result it was failed to prevent forming of doses to thyroid in some groups of Belarusian population and first of all children [3]. The main reasons of non-effective thyroid blocking were: late beginning, absence of clear scheme of distribution (who is responsible for distribution, who keeps records and knows about KI consumed with respect to later dose calculation), insufficient stocks.

Influence of ionizing radiation to the thyroid have induced cases of thyroid cancer among exposed population, especially among individuals who were exposed in childhood [9]. As a result of thyroid cancer probability estimation for I-131 exposed population aged under 6 years old based on the accepted methods, risk coefficient and using actual curves of survival of exposed population considering excess mortality from radiation-induced cancer, the following data were received: among exposed boys the expected number of thyroid cancer cases is 1100 cases during life time, among exposed girls - 2300 cases. For exposed children lived at the moment of the accident in Gomel region predicted number of cases are: for boys - 710, for girls - 1500.

The expected number of radiation-induced thyroid cancer among all exposed Belarusian population is more than 6000 cases during life time. Along with this, adequate blocking of the thyroid during first hours after the accident could allow to prevent, according to conservative estimations, about 3000...
radiation-induced thyroid cancer cases during life time among exposed population of Belarus. Given conservative values incompatible with risk of side effects for stable iodine consumption, it means: 1-10 cases of non-oncological thyroid diseases among the whole population of the Republic.

Besides urgent protective measures mentioned above, during the acute phase of the accident the different types of long-term protective actions were started. These protective actions were: prohibition of local food stuffs consumption, particularly milk (the main source of radionuclides), that permitted to decrease internal dose; and control the radionuclides content in food stuffs according to the permissible levels. In post-accidental period the standards of radioesium content in milk was severered from 370 Bq/l to 111 Bq/l. Averted internal doses for urban population of the most contaminated Gomel and Mogilev regions at the cost of introduced in 1990 and 1992 changes of National Standards for milk was 2,200 person-Sv and 1,800 person-Sv correspondingly. Prevented probabilities of stochastic effects for urban population of Gomel and Mogilev regions were not less than 110 and 88 cases of fatal cancer correspondingly, and 3 and 2 cases of serious genetic disorders in the first two generations of exposed population, correspondingly. The level of avertable dose because of this action for all Belarusian population riches more than 16,500 person-Sv and about 850 fatal cancer cases were prevented. Thus, preventive measures aimed at decrease of radioesium intake with milk allowed to prevent significant part of internal dose. It should be noticed that this conclusion is mostly concerned urban population who consumed food stuffs of state production.

To decrease content of radioesium in food stuffs and milk long-term protective measures were performed in agricultural sphere. There were: agrochemical ways of decrease of radionuclides uptake through food chain (optimal utilization of fertilizers, soil liming); agrotechnical methods. Efficiency of mentioned measures were different, it allowed to decrease radioesium transfer from soil to plants from 1.5 to dozens times.

To decrease external doses of population in post-accident period decontamination of different territories was performed. It allowed in some cases to decrease external doses in some times. Because decontamination needs significant expenses and its performing during late phase of the accident is characterized by low effectiveness, decontamination measures should be off limited character.

CONCLUSIONS

All decisions about protective actions after the Chernobyl accident in Belarus were based on system of the emergency response that was in the USSR before the accident. The actions that were carried out during acute phase of the accident (evacuation and thyroid blocking) were delayed and low efficient. The actions that were carried out during intermediate and late phase of the accident were more effective, especially actions that reduced level of internal doses. These actions riches its aim to decrease the probability of development for stochastic effects among exposed population. Using the experience of low efficient thyroid blocking Ministry of Health of Belarus developed system of decision making and distribution of KI on the level of local medical services.

REFERENCES

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