What we have learned from Fukushima

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Friday March 11, 2011 was one of the most terrible days Japan has experienced in the past 60 years. A large-scale earthquake followed by a giant tsunami struck the eastern seaboard of Japan. Over 20 000 people lost their lives or are still missing. Many people have lost their homes. To make matters worse, this combined natural disaster caused a serious accident at the nuclear power plant in Fukushima. Uncontrolled ruptures and leakage from the plants led to large-scale radiation contamination in the surrounding area. We would like to express our deepest condolences to the victims of this accident.

We are now faced with the issue of how to manage radiation contamination. Every day the mass media are reporting how many Bq in water and various foods, and how many μSv per hour in the air at various locations around Fukushima. The news reports may increase public anxiety, since most people are unfamiliar with radiation burden and particularly the units used to measure it. Based on the radiation contamination, the Japanese government has ordered the evacuation of all inhabitants who lived within 20 km of the nuclear power plant. Many thousands of evacuees have been checked for their radiation exposure. Radiation contamination of water and foodstuffs is a further concern. Since the major source of radiation was iodine-131, the activity has decreased due to this substance's

relatively short physical half-life (8.04 days). On the other hand, contamination of the soil by caesium-137 will be a serious problem despite the small amount of radioactivity because of its long physical half-life (30.1 years). Most foodstuffs, including vegetables and milk, are not allowed to be marketed locally or elsewhere.

Many foreign embassies have asked their nationals to leave Japan, even if they are in areas far away from Fukushima. Many foreign students have had to stop studying at universities or colleges to return to their own countries. We are glad to hear many of them have returned to Japan after confirming radiation safety.

Under these circumstances, nuclear medicine specialists should play an important role. It is important to provide appropriate information about the units of radiation and the possible biological effects. The Japanese Society of Nuclear Medicine (JSNM) with support from many other related societies, has worked to support radiation monitoring. Our members and technologists have checked over 20 000 evacuees from the area around the nuclear power plant and found that only a few had radiation contamination over 100 000 cpm. In most cases this came from their clothes, shoes, or bags, which were easily cleared. We have now confirmed that all of these individuals are safe with no biological effects.

We in Japan are in possession of a tremendous amount of data about the biological effects of radiation from the atomic bomb casualties in Hiroshima and Nagasaki. In addition, data from the Chernobyl disaster have been helpful for understanding possible biological effects. It is reported that there may be an increased risk of thyroid cancer in children. Many specialists have discussed whether children in and around Fukushima may need thyroid block by natural inorganic iodine in order to protect them from the risk of future thyroid cancer. On the other hand, the radiation dose to the general population is considered far

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lower than that in the Chernobyl disaster (about one tenth). In addition, most Japanese people have natural intake of iodine in their food. Based on these circumstances, the JSNM has announced to the public on its homepage that thyroid block is not required for children in the Fukushima locality.

Another important issue is to provide appropriate scientific information about radiation to the public. Some elements of the media have created sensational headlines about the increase in radiation in the air and in foodstuffs. We all know that there is no biological effect without a known genetic effect. On the other hand, the upper limit of radiation dose may vary. The upper limit of radiation burden is 1–20 mSv per year depending on the individual. A threshold of 1 mSv might be quite difficult to maintain under the present conditions. On the other hand, many specialists may use different upper limits. Such apparent inconsistencies lead to increased anxiety on the part of the general public. The government or specialists should provide consistent information about the upper limits of radiation under normal conditions, in an emergency, and during the recovery phase based on the ICRP guidelines. One of the important measures is to publicly announce the latest findings of radiation monitoring at many sites in the areas concerned.

For simplicity's sake, some media have described the radiation burden by comparing it with that from diagnostic X-ray CT (estimated as 5.9 mSv per examination). This may be preferable to stating that the radiation is thousands of times higher than normal

background levels. On the other hand, many people may become anxious about the radiation risk involved with diagnostic tests. Some patients may even refuse to undergo this important diagnostic procedure. A similar tendency may be seen with the radioisotopes for medical use. We should always remember to point out that medical doctors may use diagnostic radiation only when the benefit outweighs the potential risk. In addition, the level of radiation should be as low as reasonably achievable (ALARA). Such medical radiation should be separated from the radiation contamination.

Japan is a beautiful country, surrounded by the sea and studded by mountains, including some active volcanoes. Throughout its long history, Japan has experienced a number of serious earthquakes and tsunamis, with the loss of thousands of lives. Each time, however, the country has recovered after strong efforts. This time as well, Japan will surely recover. Nevertheless, we will need advice on how to manage radiation contamination and biological effects from specialists the world over, particularly members of various nuclear medicine societies. With our hard work and specialist support from all over the world, Japan will recover from this terrible disaster and become stronger than before. We would like to record our appreciation of the warm sympathy and strong encouragement from people all over the world.

Particularly, we would like to express sincere gratitude for all the kind considerations from nuclear medicine societies and their members.