Acute Intake of Radionuclides Immediately After the Incident as the Main Contributor of the Internal Radiation Exposure After Fukushima Daiichi Nuclear Disaster

The Fukushima Daiichi nuclear disaster is a series of equipment failures, nuclear meltdowns, and release of radioactive materials, raising serious health concerns in nearby residents. We recently reported that levels of internal radiation exposure (IRE) by radioactive cesium in Minamisoma, Fukushima were low; however, it is not as certain whether the detected levels of exposure were due to low ongoing exposure or decay from high-exposure values. To address this issue, transition of IRE among Minamisoma residents was monitored for children younger than 16 years, with biological half-lives of cesium in children up to age 15 years described as less than 93 days.

Methods | The institutional review board of the Institute of Medical Science, University of Tokyo, approved the study, and written informed consent was obtained from all participants. A voluntary screening program for cesium exposure, cesium 134 and cesium 137, known to be representative of total IRE, started on September 26, 2011, for all Minamisoma residents 6 years or older using a whole-body counter (FASTSCAN model 2251; Canberra Inc). The monthly percentages of people with positive cesium exposure were calculated between September 2011 and September 2012.

Results | A total of 3992 children (1975 girls, 49.5%) were enrolled in the study, accounting for 66% of the corresponding registered population of Minamisoma in 2010. Among them, 2831 children (71%) lived in Minamisoma at the time of the examinations. The median age was 11 years (range, 6-15 years), and 325 individuals (8.1%) had detectable levels of cesium but not the other radionuclides. The monthly detection rates of cesium are displayed in the Figure. There was a clear declining trend from September 2011 (57.5%) to September 2012 (0.0%) and sustained zero after June 2012. While total cesium exposure was converted into committed effective dose (in sieverts) based on the assumption of chronic cesium ingestion after the disaster, committed effective doses were less than 1 mSv in all participants.

Discussion | This study demonstrates that levels of chronic IRE in children are marginal and vanishing 1 year after the nuclear accident. Such rapid disappearance appears attributable to the fact that the Japanese government took quick action to restrict the circulation of foods with confirmed or suspected contamination. On March 21, 2011, 10 days after the disaster, the Japanese government announced a ban on sales of spinach and raw milk from Fukushima and neighboring prefectures. Subsequently, the local governments, volunteers, and farmers conducted thorough radioactivity checks on food before shipment. These measures appear successful in reducing the chronic IRE at the moment; however, to avoid the risk of recurrent IRE by unknowingly eating contaminated food, long-term measures including continuous monitoring, individually targeted interventions for those identified at high risk of IRE, and public education are warranted.
Also, this study showed that the detected cesium was mainly derived from the acute intake of radionuclides immediately after the incident. Acute IRE is much more significant than measurable chronic IRE after a certain period in the health risk assessment of the nuclear disaster.

It is important to calculate the internal radiation doses immediately after the incident to predict future health risks, particularly for younger generations; however, we had lost the opportunity to obtain actual values of IRE at the acute stages. Although committed effective dose might be predictable based on the assumed scenarios using available environmental monitoring data or the results of in vivo measurements performed after a certain period from the incident, these estimations could vary with methods and the assumption. Our case clearly demonstrates the necessity of personal in vivo measurements as soon as possible after the nuclear disaster to make an accurate prediction for future health risks of radiation.

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Leveraging Electronic Health Records to Notify Pediatric Patients of a Drug Recall

Drug recalls have become an unfortunately frequent event in the United States, with nearly 1 clinically relevant drug recall per month in the last 5 years. A national management strategy on medical device recalls is currently being debated by government and health officials. We report the use of the National Institutes of Health-sponsored Informatics for Integrating Biology & Bedside (i2b2) platform as an approach to speed patient identification and direct notification of a voluntary drug recall by leveraging data available in the electronic health record (EHR).

On November 9, 2012, specific lots of the generic version of atorvastatin calcium, distributed by Ranbaxy Pharmaceuticals Inc, a subsidiary of a multinational corporation, were reported as possibly contaminated with “very small glass particles resembling a fine grain of sand.” A voluntary recall was announced by the company and reported to the general public by news organizations. A US Food and Drug Administration (FDA) notice on November 28, 2012, recommended that patients contact their health care provider with any symptoms related to taking the medication and health care providers report any suspected adverse events to the FDA.

A team of physicians, a nurse practitioner, and a nurse who provide clinical care in the Preventive Cardiology program at Boston Children's Hospital felt obligated to inform the pediatric patients prescribed atorvastatin and their families of the drug recall in a targeted and efficient approach to (1) identify those at risk and (2) prevent unnecessary discontinuation of beneficial treatment.

Methods | The i2b2 platform was approved for human subjects research by the Boston Children’s Hospital institutional review board; additional approval for the use in this context was not needed. Using the i2b2 platform, we queried patients who were prescribed atorvastatin in the preceding 2 years among those seen in Pediatric Cardiology outpatient clinics. These persons were reidentified using an honest broker intermediary under the guise of a patient safety data request. An intermediate agent allowed the reidentification of clinical data from the deidentified source without revealing the identities of others in the i2b2 system. We corroborated this list in the EHR and informed appropriate patients by telephone and mail.