

Massive expansion of multiple clones in the mouse hematopoietic system long after whole-body X-irradiation

Clonal hematopoiesis (CH)¹ is reported to be fairly common in the elderly (about 10% of people aged 65 and older) and associated with the development of blood cancers and diseases of the heart and blood vessels. The risk (probability of occurrence) of these diseases is known to increase above a certain level of radiation dose among A-bomb survivors. This paper was based on a study utilizing a mouse model and the latest DNA analysis technology to investigate whether radiation exposure induces CH.

In the study, RERF observed mice following exposure to 3 gray (Gy)² of whole body, X-ray irradiation over the relatively long duration of 12–18 months. The study confirmed CH in 11 of 12 irradiated mice but not in 6 non-irradiated mice, suggesting the possibility that CH-related mutations had been induced in the mice exposed to radiation. Additionally, the CH observed in this study had two characteristics: the CH found in most of the mice exposed to radiation had a large proportion of clonal blood cells derived from a single hematopoietic cell; and, when mutation frequency was examined by proliferating each of the bone marrow hematopoietic cells in 2 of the mice exposed to radiation in a test tube (in vitro), multiple mutations within the same hematopoietic cell were found to result from the exposure to high-dose radiation of 3 gray (Gy).

This study's findings are expected to encourage further research to clarify the mechanisms of CH occurrence following radiation exposure.

Notes

¹ Clonal hematopoiesis (CH):

Refers to the replacement of a portion of the cell population in the bone marrow, a source of blood production, with mutated cell clones (genetically identical cells) as a result of aging. This process might be involved in the development of a variety of diseases, including heart and blood vessel diseases as well as blood cancers, making it a focus of active research in recent years.

² Gray (Gy): Gray (1 gray = 1,000 milligray) is a unit of radiation that represents the amount of radiation dose absorbed by a substance when it is exposed to radiation. The average dose for RERF's LSS participants is around 140–200 milligray (0.14–0.2 Gy). As reference, the average annual amount of radiation we are all exposed to in our daily lives, include medically, is estimated to be around 2–6 milligray (0.002–0.006 Gy).

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RERF's objective with this brief outline is to succinctly explain our research for the lay public. Much of the technical content of the original paper has been omitted. For further details about the study, please refer to the full paper published by the journal.