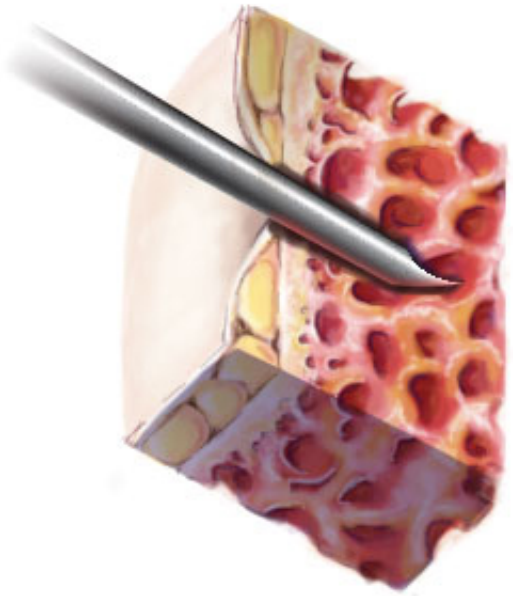
# New blood test quickly reveals severity of radiation injury

May 13 2015



The hematopoietic system consists of blood and the organs that produce it, including the bone marrow (above). It is the most vulnerable system in the body to radiation toxicity. A new study by Sanket Acharya and colleagues finds that microRNA signatures can predict long-term damage to bone marrow cells caused by radiation exposure. Credit: V. Altounian / Science Translational Medicine

A novel blood test could greatly improve triage of victims of radiation accidents by rapidly predicting who will survive, who will die, and who

should receive immediate medical countermeasures, according to scientists at Dana-Farber Cancer Institute.

In pre-clinical trials, the test was able to reveal within 24 hours whether survivable doses of radiation or doses that caused severe injury to the bone marrow and other organs would eventually prove fatal. Use of such a test, the researchers said, could "facilitate timely medical intervention and improve overall survival of exposed individuals."

Reporting in *Science Translational Medicine*, the scientists say that, unlike current methods, their blood biomarker test quickly determines the functional impact of radiation rather than simply the dose to which the individual was exposed. Often, the effects of severe radiation exposure develop slowly over weeks or months. Current methods - such as observing when radiation sickness appears - are inexact and don't measure the extent of long-term injury to the bone marrow and other organs.

"After a radiation release, there is currently no way to tell who was exposed and who wasn't, and if someone was exposed, is it lethal or not?" said Dipanjan Chowdhury, PhD, a principal investigator in Dana-Farber's Department of Radiation Oncology, the report's senior author. Drugs that can limit bone marrow damage are available but, to be effective, must be given before the appearance of radiation symptoms.

The need for faster, more definitive predictive tests was highlighted by radiation accidents such as the 2011 reactor meltdown at the Fukushima Daiichi plant in Japan, radiation releases from Chernobyl and Three Mile Island, as well as the potential for terrorist radiologic weapons. Chowdhury and his colleagues undertook the new study with federal funds designated for radiation exposure biomarkers research in the wake of the Fukushima accident.

In a search for such biomarkers, the investigators focused on microRNAs, or miRNAs. These are tiny RNA molecules, first identified about 20 years ago, that help regulate gene activity. They are made in cells, but some miRNAs are found in the bloodstream, and the scientists asked whether varying doses of radiation might cause corresponding changes in miRNA in the blood.

Experiments showed that 68 of 170 miRNAs detected in blood serum changed with radiation exposure, and these were narrowed down to a small number that acted as a "signature" of radiation dose. Mice exposed to two radiation doses, one lethal and one survivable, showed no outward differences for three to four weeks. But using the miRNA signature, the scientists were able to predict within 24 hours which animals would survive.

An indication that the test would work similarly in people came from experiments using mice who received transplants of human bone marrow. The blood test gave the same indication of damage to the human cells as it had in the previous experiments with non-humanized mice. In addition, when the researchers gave the mice a radiation protection drug that "rescued" many of the human cells, the miRNA test results confirmed this protective effect.

The scientists noted that the miRNA changes that can be seen at 24 hours after the exposure disappear in a matter of days, so they plan to look for other miRNA signatures that have a longer duration.

**More information:** Serum microRNAs are early indicators of survival after radiation-induced hematopoietic injury, *Science Translational Medicine*, stm.sciencemag.org/lookup/doi/ … scitranslmed.aaa6593

Provided by Dana-Farber Cancer Institute