There's life after radiation for brain cells

12 August 2013

Scientists have long believed that healthy brain cells, once damaged by radiation designed to kill brain tumors, cannot regenerate. But new Johns Hopkins research in mice suggests that neural stem cells, the body's source of new brain cells, are resistant to radiation, and can be roused from a hibernation-like state to reproduce and generate new cells able to migrate, replace injured cells and potentially restore lost function.

"Despite being hit hard by radiation, it turns out that neural stem cells are like the special forces, on standby waiting to be activated," says Alfredo Quiñones-Hinojosa, M.D., a professor of neurosurgery at the Johns Hopkins University School of Medicine and leader of a study described online today in the journal *Stem Cells*. "Now we might figure out how to unleash the potential of these stem cells to repair human brain damage."

The findings, Quiñones-Hinojosa adds, may have implications not only for brain cancer patients, but also for people with progressive neurological diseases such as multiple sclerosis (MS) and Parkinson's disease (PD), in which cognitive functions worsen as the brain suffers permanent damage over time.

In Quiñones-Hinojosa's laboratory, the researchers examined the impact of radiation on mouse neural stem cells by testing the rodents' responses to a subsequent brain injury. To do the experiment, the researchers used a device invented and used only at Johns Hopkins that accurately simulates localized radiation used in human cancer therapy. Other techniques, the researchers say, use too much radiation to precisely mimic the clinical experience of brain cancer patients.

In the weeks after radiation, the researchers injected the mice with lysolecithin, a substance that caused brain damage by inducing a demyelinating brain lesion, much like that present in MS. They found that neural stem cells within the irradiated subventricular zone of the brain generated new cells, which rushed to the damaged site to rescue newly injured cells. A month later, the new cells had incorporated into the demyelinated area where new myelin, the protein insulation that protects nerves, was being produced.

"These mice have brain damage, but that doesn't mean it's irreparable," Quiñones-Hinojosa says. "This research is like detective work. We're putting a lot of different clues together. This is another tiny piece of the puzzle. The brain has some innate capabilities to regenerate and we hope there is a way to take advantage of them. If we can let loose this potential in humans, we may be able to help them recover from radiation therapy, strokes, brain trauma, you name it."

His findings may not be all good news, however. Neural stem cells have been linked to brain tumor development, Quiñones-Hinojosa cautions. The radiation resistance his experiments uncovered, he says, could explain why glioblastoma, the deadliest and most aggressive form of brain cancer, is so hard to treat with radiation.

Provided by Johns Hopkins University School of Medicine