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Stem cells restore cognitive abilities impaired by brain cancer treatment

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Human neural stem cells are capable of helping people regain learning and memory abilities lost due to radiation treatment for brain tumors, a UC Irvine study suggests.

Research with rats found that stem cells transplanted two days after cranial irradiation restored cognitive function, as measured in one- and four-month assessments. In contrast, irradiated rats not treated with stem cells showed no cognitive improvement.

"Our findings provide solid evidence that such cells can be used to reverse radiation-induced damage of healthy tissue in the brain," said Charles Limoli, a UCI radiation oncology professor.

Study results appear in the July 15 issue of *Cancer Research*, a journal of the American Association for Cancer Research.

Radiotherapy for brain tumors is limited by how well the surrounding tissue tolerates it. Patients receiving radiation at effective levels suffer varying degrees of learning and memory loss that can adversely affect their quality of life.

"In almost every instance, people experience severe cognitive impairment that's progressive and debilitating," Limoli said. "Pediatric cancer patients can experience a drop of up to three IQ points per year."

For the UCI study, multipotent human neural stem cells were transplanted into the brains of rats that had undergone radiation treatment. They migrated throughout the hippocampus – a region known for the growth of new neurons – and developed into brain cells.

Researchers assessed the rats one month and four months after transplantation, noting enhanced learning and memory abilities at both intervals.

Additionally, they found that transplanting as few as 100,000 human neural stem cells was sufficient to improve cognition after cranial irradiation. Of cells surviving the process, about 15 percent turned into new neurons, while another 45 percent became astrocytes and oligodendrocytes – cells that support cerebral neurons.

Most notably, Limoli said, he and his colleagues discovered that about 11 percent of the engrafted cells expressed a behaviorally induced marker of learning, indicating the functional integration of those cells into memory circuits in the hippocampus.

"This research suggests that stem cell therapies may one day be implemented in the clinic to provide relief to patients suffering from cognitive impairments incurred as a result of their cancer treatments," Limoli said. "While much work remains, a clinical trial analyzing the safety of such approaches may be possible within a few years, most likely with patients afflicted with glioblastoma multiforme, a particularly aggressive and deadly form of brain cancer."

Provided by University of California - Irvine

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