Unlocking the Mysteries of Brain Tumors

Central Illinois Neuroscience Foundation

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Among the many forms of cancers, brain cancer can be one of the most deadly. In the United States, approximately 43,000 people each year are diagnosed with some form of brain tumor and nearly 13, 000 of those die. These tumors range from benign, curable cancers to certain forms, which, even with the best treatment, lead to death in a little over one year.

Brain tumors generally arise from one of two sources, either from brain cells themselves or from cancers that originate in another place in the body such as lung, prostate or breast that spread the brain. As they grow, tumors cause pressure on the brain, leading to neurological deficits such as weakness or decreased sensation. Ultimately, these growing tumors may exert enough pressure to cause a coma or even death.

Certain types of brain tumors, such as meningiomas or vestibular schwannomas, can be treated solely by surgery or radiation. Unfortunately, little progress has been made in the treatment of the more deadly forms of brain cancer. These more lethal tumors arise from glial cells. Glial cells provide nutrients and other support to the neurons, cells that communicate messages to and from the brain to the rest of the body.

Despite the lack of progress in new treatments, there have been some promising discoveries in unlocking the mysteries of the causes of brain tumors. Researchers have recently found that brain tumors may arise from cancerous stem cells.

The human body is continually regenerating most of its tissues through stem cells. This is a normal function of the body, which allows it to regenerate old or non-functioning cells. For example, when a bone is broken, stem cells specific to bone, divide. One of the divided cells will remain a stem cell and the other may become one of several types of bone cells needed to heal a fracture. However, researchers have discovered that some stem cells may be involved in the initiation or propagation of cancer in certain tissues. This was first seen in forms of leukemia and breast cancer, but more recently, scientists have found this in certain types of brain cancer. These cells are now being called cancer stem cells.

Glial cells are frequently the culprit behind tumors arising from inside the brain. One of the worst forms of this type of tumor is called glioblastoma multiforme (GBM). Recently, researchers at the University of Toronto have found that these tumors contain stem cells that can be identified by DNA markers. Now tracking and studying these cells, researchers hope to develop therapies to specifically target and kill these cells.

Advances is chemotherapy

A new chemotherapy drug called Temodar has also provided promise in the treatment of these malignant glial tumors. The advantage of Temodar is that it has a relatively low amount of side effects, which, in the past, have plagued cancer patients. Studies have shown that when combined with radiation therapy, patients receiving Temodar for high-grade glial tumors, such as GBM, lived longer than those treated with radiation alone.

Advances in radiation therapy

Radiation is a common treatment modality for many forms of cancer. The first attempts to treat brain tumors with radiation used small doses to the entire brain given over a period of weeks. This irradiated the tumor but normal tissues as well. Fortunately, new techniques allow specialists to target many brain tumors with focused radiation while sparing normal surrounding brain tissue.

One of the most advanced technologies is the Cyberknife robotic radiosurgery device developed at Stanford by Dr. John Adler. In 2003 one of the first of these machines was installed at the Community Cancer Center in Normal. The device utilizes a robot, normally used to assemble automobiles, to specifically direct beams of radiation to tumors.

For Cyberknife radiosurgery, a person with a tumor first undergoes a series of specialized imaging techniques. Images are loaded into a computer and are used by a neurosurgeon and a radiation oncologist to identify and isolate the tumor. High-powered computers, under the direction of a medical physicist, are then used to precisely calculate an individualized program of radiation delivery.

The Cyberknife technology can be used for brain and spinal tumors but also for other malignancies such as lung, breast or other cancers. A significant advantage is that these tumors can usually be treated in one or two sessions taking no more than a few hours.

For practitioners and patients, brain cancer in its more deadly forms is a humbling and puzzling disease. Many researchers and clinicians are working feverishly to advance our understanding of these tumors. Fortunately, progress has been made. Discoveries such as brain tumor stem cells may provide future breakthroughs in treating these cancers.

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The Central Illinois Neuroscience Foundation (CINF) is a non-profit organization dedicated to enhancing neurological healthcare through education and research.