UCLA Health

New 4π radiation therapy provides treatment option for patients with recurrent glioblastoma

The first line of therapy for patients diagnosed with a rare, aggressive and malignant type of primary brain tumor called glioblastoma multiforme typically involves surgery to remove as much of the tumor as possible, followed by chemotherapy and radiation to eradicate remaining malignant cells. While this regimen often alleviates symptoms like pressure headaches and nausea and increases survival, glioblastoma almost always recurs, often within the first year after treatment.

More than 80 percent of the time, glioblastomas return to the same location as the original mass. Because the initial round of radiation treatment likely exposes crucial brain structures to the full dose that can be tolerated without negatively impacting the patient's speech, sight and other important functions, a second targeted round of radiotherapy has often been deemed unsafe.

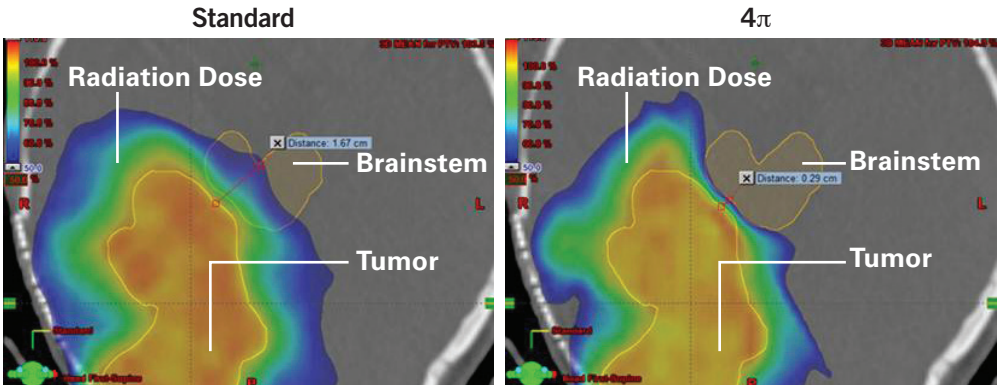
Recently, a UCLA medical physicist developed a new method of external-beam, high-definition radiation therapy — called 4π radiation therapy — that can deliver a dose of radiation more precisely and compactly to the area of recurrence, with less spillover into healthy areas of the brain. The UCLA Department of Radiation Oncology is now offering this treatment approach as part of a Phase 1 clinical trial for patients with recurrent glioblastoma.

A "game-changer" in radiation oncology

When using radiation therapy, the goal is to deliver as much radiation as possible to the intended target while minimizing damage to healthy, surrounding tissues. Because there are so many critical structures in the brain, the challenge of targeting radiation is even more crucial when treating glioblastomas.

4π radiotherapy delivers a more compact dose of radiation therapy than existing methods, and for this reason, represents the "next big thing in radiation therapy," says Tania Kaprealian, MD, the radiation oncologist who's leading the UCLA 4π clinical trial. "I think it's a game-changer."

Created by Ke Sheng, PhD, a medical physicist in UCLA's Department of Radiation Oncology, 4π radiation therapy minimizes the amount of radiation that healthy tissues receive. "When dealing with brain-tumor patients, I need a method where I can spare normal structures better while still giving them the opportunity to have another treatment," Dr. Kaprealian says. "The 4π approach is excellent at doing just that."



A comparison of standard and 4π radiotherapy showing the radiation doses as colormaps on top of the brain CT image. The standard treatment would result in a dangerously high dose to the brainstem and may exclude the patient from receiving the therapy. 4π radiotherapy is able to spare the critical organ.

About 4π radiation therapy

4π photon radiation therapy uses an existing system of C-arm gantry linear accelerators, which utilize a high number of non-coplanar beam angles to deliver targeted radiation doses. 4π refers to the specific algorithm used to plan and deliver treatment, using a higher number of treatment beam angles and couch movements, and providing greater plan quality than typical rapid-arc or intensity-modulated radiation therapy. With 4π radiotherapy, more critical tissues are spared, while the same or superior tumor coverage is achieved. By better sparing healthy areas of the brain — and more precisely targeting tumor cells — radiation oncologists are able to re-treat patients who would otherwise be turned away.

While there is still no cure for this disease, 4π radiation therapy gives patients with recurrent glioblastoma a safe treatment that could slow tumor growth, lessen symptoms and extend life.

The clinical trial

At present, 4π radiation therapy is available only at UCLA, where it is being offered as part of a Phase 1 clinical trial for patients with recurrent glioblastoma multiforme who have previously undergone standard treatments.

Patients enrolled in the clinical trial will undergo a CT scan to develop a 3D model and map out the best treatment plan. Depending on that plan, they will undergo five to 10 radiation treatments. Participants are asked to complete a questionnaire about their experience at the conclusion of the therapy.

The Department of Radiation Oncology is evaluating the safety and efficacy of this new treatment approach. Since the trial launched in December 2014, the team has used 4π radiation therapy on a handful of patients, all of whom tolerated the treatment well. UCLA researchers hope to enroll a total of 10 patients in the trial.

While 4π radiation therapy is currently available only as part of this trial for patients with recurrent glioblastoma, the team hopes to extend this approach to other types of cancer and other body sites in the future.

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