Study of brain tumor adds up to better treatment

By Jessica Tobacman, Special to the Tribune

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A Northwestern University professor has come up with a mathematical model that she says accurately predicts the growth of the most aggressive and common type of brain tumor, a breakthrough she says will help doctors combat the tumor more effectively.

Professor Kristin Swanson, a neurologist at Northwestern's Feinberg School of Medicine, and her research team came up with the model to predict the growth of glioblastoma, a type of brain tumor.

"We are thrilled. This is a new tool. By generating a prediction of the growth of the tumor, it tells you the growth curve," said Swanson, who did much of the research at the University of Washington before she came last year to Northwestern as professor and vice chair of research for neurological surgery. "A bigger patient response to the therapy means they will live longer."

Swanson and her colleagues used mathematical models on computers to run simulations about the growth of a glioblastoma tumor without treatment. The models are similar to those used by meteorologists to track the growth and movement of storms, she said.

"There are similar mathematics behind weather predictions and brain tumor outcomes," Swanson said. "Instead of mathematical modeling of the storm, this is a mathematical modeling of the tumor. Proliferation and invasion is the most important part of glioblastoma. With glioblastoma, there's no time in which there's only a lump; there's a gradient of cell density. There's an invasion you can't see, because a few cells are migrating here and there."

Learning how fast a patient's glioblastoma is growing helps doctors understand how to fight it, she said. Currently, the only option is a one-size-fits-all approach to treating tumors, but not all tumors are the same, Swanson said.

"It's a challenge because this disease has diversity in size, shape, how fast it grows and invades, and how fast it creates symptoms," she said.

In other types of cancer, such as in lung cancer, whether or not the visible tumor shrinks indicates whether it is responding to treatment.

"But in glioblastoma, this isn't true," Swanson said. "The 'response criteria' for glioblastoma is understanding the speed: We generate the simulated prediction of what the tumor would have looked like if we hadn't treated the patient, and then use that as a base line to understand how far (the therapy) deflected tumor growth."

Swanson's research team published a paper about the mathematical model, "Discriminating Survival Outcomes in Patients with Glioblastoma Using a Simulation-Based, Patient-Specific Response Metric," in the PLOS ONE journal on Jan. 23. Swanson studied glioblastoma brain cancer in 33 patients, all of whom have since died.

"We're trying to make the simplest possible tool to hand to clinicians and patients for them to get a sense of (the progress made) through treatment," Swanson said.

Clinicians can get a better idea of how well the therapy is working, which helps them to determine whether to change the therapy.

The next steps include using this mathematical model to test the effectiveness of new therapies, Swanson said.

Dr. Steven Brem, a professor of neurosurgery and co-director of the Penn Brain Tumor Center at the Hospital of the University of Pennsylvania, said the findings by Swanson team's are "highly innovative, exciting and offer an important tool to accelerate drug discovery and ultimately find an effective therapy for patients suffering from glioblastoma."

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