Research is uncovering new ways to treat an aggressive brain cancer

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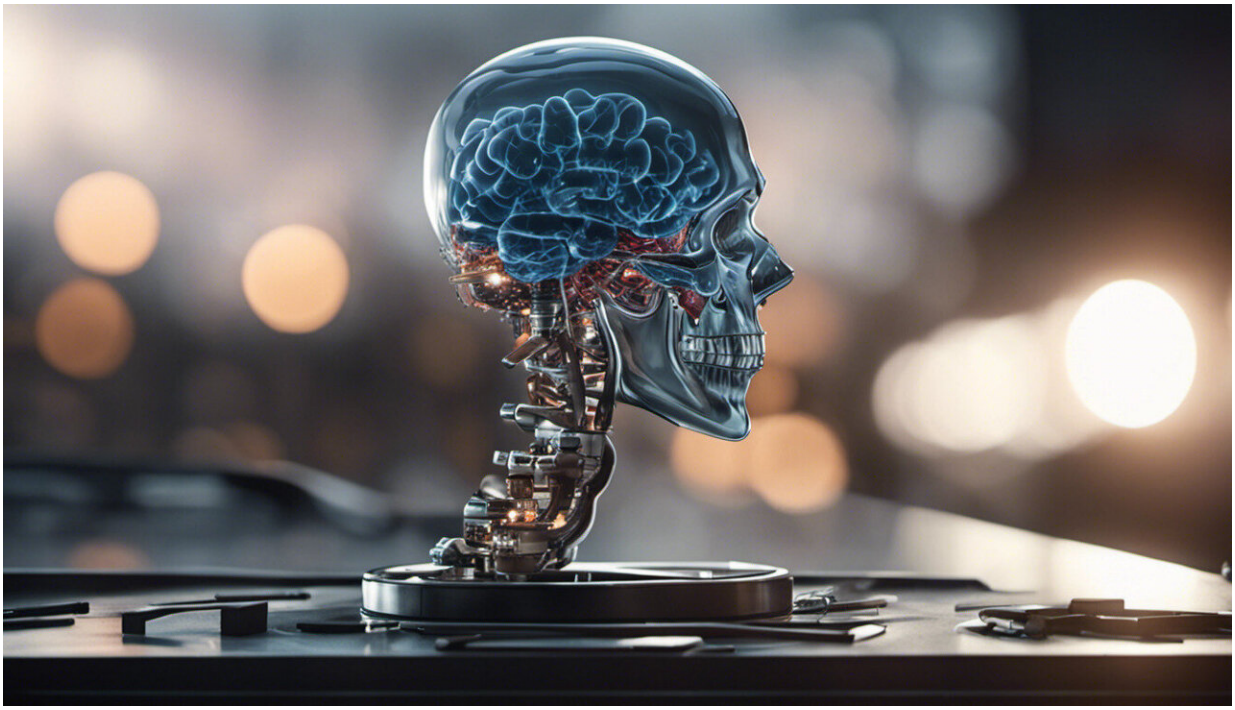

Credit: AI-generated image (disclaimer)

Brain surgeons need steady hands as well as cool heads. Now they're getting a helping hand from researchers in Europe to fight a fatal type of brain cancer called glioblastoma.

A Danish biotechnology company named FluoGuide led a research

project that received EU funding to pinpoint glioblastoma better so surgeons can more easily remove it. FluoGuide developed a fluorescent chemical dye that's injected into patients before surgery.

Real-time help

The compound locks onto aggressive cancer cells through an enzyme that the rogue cancer cells use against the body. Once a physician shines an infrared light onto brain tissue during an operation, the cancer cells with this enzyme fluoresce.

"We basically light up the cancer and help the surgeon remove it in real time," said Morten Albrechtsen, FluoGuide's chief executive officer.

No cures exist for glioblastoma, which is the most common type of malignant brain tumor. This type of cancer is on the rise in many countries, and patient survival is on average around 15 months.

In Europe, approximately 15,000 people die annually from glioblastoma.

The EU-funded project—called INSTAGLOW—that FluoGuide led ran for two and a half years until the end of 2022. The research showed the company's breakthrough to be safe in patients.

FluoGuide uses a system based on work done by academics at Copenhagen University Hospital—Rigshospitalet—and the University of Copenhagen decades ago.

Shining chemical

A crucial part of the technology relies on an enzyme called uPAR, which stands for urokinase-type plasminogen activator receptor. Tumors wield

uPAR enzymes like a molecular machete, chopping through healthy cells to make room for a growing cancer.

FluoGuide developed a protein attached to a fluorophore—a chemical that shines when hit by light. The protein-fluorophore tandem gets injected into the patient, circulates in the body and attaches itself to the uPAR cancer cells.

During surgery, an infrared light is directed at brain tissue and reveals where the fluorophore and, by extension, the uPAR is in the brain.

The enzyme is most abundant at the boundary of a tumor and healthy tissue, giving surgeons a visual guide to where the cancer ends and the healthy tissue begins. This allows them to skirt away from noncancerous parts of the brain.

The product has been tested in 36 patients with aggressive brain cancer in Denmark and Sweden.

The next steps are for it to be tested in more patients in Europe as well as ones in the U.S. as they undergo surgery for glioblastoma. Success here would allow the product to be approved for widespread use.

Better MRI

Another strategy for battling glioblastoma is to introduce special viruses that seek and destroy the tumor.

While hospitals are moving closer to using these so-called oncolytic viruses, they have yet to be approved as a treatment. A major challenge is to gauge the effects of this therapy within the brain.

Ordinary MRI relies on differences in the magnetic properties of water

in tissues and can be used to "see" a brain tumor. But MRI has shortcomings when it comes to revealing early changes in a tumor during a treatment.

Dr. Or Perlman, a biomedical engineer at the University of Tel Aviv in Israel, has worked with researchers in Germany and the US to tweak MRI to suit this purpose better as part of a second EU-funded project.

Called OncoViroMRI, the initiative wrapped up in June 2023 after 44 months.

Instead of relying on water content, Perlman's approach relies on other molecules to generate a superior image of a tumor in the brain.

The ultimate plan is to inject patients with cancer-killing viruses and then use this MRI approach to monitor the effect of the viruses on the cancer. It is thought that immune cells would also be prompted by the viruses to target and kill infected cancer cells.

"The idea was to come up with a map that shows you dying cells in the brain, so revealing which regions of the tumor respond to the virus," said Perlman.

The work by researchers under OncoViroMRI was mostly done in laboratory mice. Medical doctors took part in the project in an effort to help draw lessons for the treatment of patients.

Need for speed

The challenge now for scientists like Perlman is to make the imaging fast enough. This requires artificial intelligence to decipher the data from MRI and turn it into a readable map that doctors can use to track patient progress.

One upside is that this didn't need any changes in the MRI equipment, so in future it could be plugged into a normal hospital procedure.

"The next step is to study a small number of patients with tumors to see if we can track their cancer," said Perlman.

The strategies developed under both OncoViroMRI and INSTAGLOW should be applicable to other types of cancer as well.

Back in Copenhagen, FluoGuide has shown its new product can work in lung cancer patients. Also on its radar is breast cancer in women and head and neck cancer.

The company's product was tested on 16 patients with lung cancer and clinical testing is taking place of the dye in patients with head and neck cancer.

"So far it has worked extremely well for brain cancer," said Albrechtsen.

More information:

- INSTAGLOW
- OncoViroMRI

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