Operating on brain gliomas by detecting the 'glow'

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Research by Barrow Neurological Institute physicians and University of Washington scientists on novel imaging technology for malignant brain tumors was published in the April issue of *World Neurosurgery*. The research was conducted by Drs. Evgenii Belykh and Mark Preul at the Barrow Neurological Institute Neurosurgery Research Laboratory with technology developed by Drs. Eric Seibel and Leonard Nelson from the Department of Mechanical Engineering and the Human Photonics Laboratory at the University of Washington.

At Barrow they used a Scanning Fiber Endoscope (SFE) to detect the glow produced by adding the pro-drug 5-ALA to experimental models of malignant brain tumors. 5-ALA is metabolized in tumors to a fluorescent Porphyrin and is approved for administration to patients to increase the detection of the margin of invading brain glioma tumors, and thereby allow for a wider or more extensive brain tumor removal. SFE allows the neurosurgeon to visualize the fluorescent light produced by 5-ALA earlier and for longer periods of time than visually possible with a standard operative microscope. SFE offers sufficient image resolution to observe individual brain and tumor cells and the scanning feature reduces the photobleaching of the fluorescent signal which can be problematic in the operating room.

The SFE scope uses low-power laser light that is scanned with an actuator at the tip of a highly flexible shaft with overall diameter about the thickness of a nickel. For surgical guidance, two modes of imaging are generated concurrently at video rates, fluorescence to see the tumor,

and reflectance imaging to see the surgical field and the surgical tools.

Drs. Seibel and Nelson commented, "The combination of high sensitivity and long viewing time of the fluorescently-labeled cancer should allow the guidance necessary for more complete tumor margin clean-up."

Drs. Belykh and Preul relate, "The advancement of this particular instrument that is the size of a pen, showing imaging on-the-fly to the surgeon as the tumor resection progresses represents next generation surgical technology that will help brain surgeons and pathologists identify the margins of invading tumor in the operating room. Fluorescence and optical labeling techniques are increasingly used in the operating room to specifically identify and discriminate brain tumor tissues and cancers in other areas of the body. This technology is positioned to guide the surgeon's tumor resection and allow "optical biopsies" that will increase the yield of confirmatory tissue sampling. Importantly, visualization technology such as SFE should help in deciding also in where to stop the brain tumor resection. We're using incredible technology that we believe will contribute to optimizing survival for patients with gliomas and other brain tumors."

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The UW SFE technology is licensed and commercial prototypes are undergoing pre-clinical trial evaluations. Preliminary SFE imaging studies using tissue penetrating near-infrared (NIR) targeting agents have demonstrated excellent tumor contrast in animal models. Barrow and the University of Wisconsin plan to expand their collaboration into improved tumor resection using the SFE and NIR agents.

Provided by St. Joseph's Hospital and Medical Center

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