

5-ALA fluorescence guides resection of recurrent glioblastoma multiforme

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Neurosurgeons from UC San Francisco describe the use of 5-aminolevulinic acid (5-ALA) fluorescence in guiding resection of recurrent glioblastoma multiforme (GBM). Ingestion of 5-ALA by a patient before surgery leads to fluorescence of tumor cells intraoperatively in response to certain wavelengths of light. This can provide information not necessarily available through magnetic resonance imaging (MRI), the standard mode of imaging used to detect primary and recurrent GBMs. The additional information provided by 5-ALA fluorescence can guide surgeons in the treatment of individual cases.

The case of a 56-year-old man is described in the article "Subependymal spread of [recurrent glioblastoma](#) detected with the intraoperative use of 5-aminolevulinic acid. Case report," by Tene A. Cage, M.D., Melike Pekmezci, M.D., Michael Prados, M.D., and Mitchel S. Berger, M.D., published today online, ahead of print, in the [Journal of Neurosurgery](#). The patient presented with frequent transient visual disturbances. Seven years earlier, he had undergone gross-total (maximum) resection of a GBM located in the right occipital lobe. A new MRI study was performed and the images showed three distinct, new sites of tumor in the man's right temporal lobe. There was no evidence of recurrent tumor at the site where the original tumor had been located.

[Glioblastoma multiforme](#) (GBM) is the most common primary tumor of the brain. It is extremely aggressive and is usually treated with resection followed by chemotherapy and radiotherapy. Even using this treatment,

patient survival is not long: on average 1 to 2 years. The authors note that the best way to lengthen survival is to remove as much tumor as possible. This holds for recurrent GBM as well as for the initial tumor.

The patient in this case was scheduled for [surgery](#) to remove the three new lesions. To aid in visualization of the lesions intraoperatively, the neurosurgical team, led by Mitchel S. Berger, M.D., Chairman of the Department of Neurological Surgery at UC San Francisco, administered 5-ALA to the patient four hours prior to surgery. During surgery, a blue light was used to activate 5-ALA fluorescence of [tumor cells](#) and thus differentiate tumor from other brain tissue. Using the blue light, the surgeons were able to detect tumor cells along the lining of the right lateral ventricle, in the ependymal and subependymal regions. Although the appearance of the three lesions on preoperative MRI had indicated distinct sites of recurrent disease (multicentric tumor recurrence), the fluorescence of tumor cells during surgery mapped out the spread of disease from the original GBM site in the right occipital lobe to three sites in the right temporal lobe through a pathway along the wall of the right ventricle. This showed that the GBM recurrence was not multicentric at all. The fluorescence also made it possible for the surgeons to identify and resect additional tumor tissue along the pathway between the original and recurrent lesions.

According to the authors, MRI is unable to clearly delineate diffuse tumor infiltrating the ependyma and subependymal zone lining the lateral ventricle. Addition of 5-ALA fluorescence during surgery revealed the pathway of tumor spread through these regions.

With recurrent GBM, it is valuable to distinguish whether the recurrence is multicentric disease or infiltrative disease extending from the original [tumor](#). According to Dr. Berger, "Multicentric disease can add a worse prognosis. Finding it during surgery is important and can influence the extent of resection." Addition of 5-ALA [fluorescence](#) has been

identified as substantially increasing the success of achieving maximum resection. Dr. Berger says that intraoperative use of 5-ALA "could be useful in all GBM cases."

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