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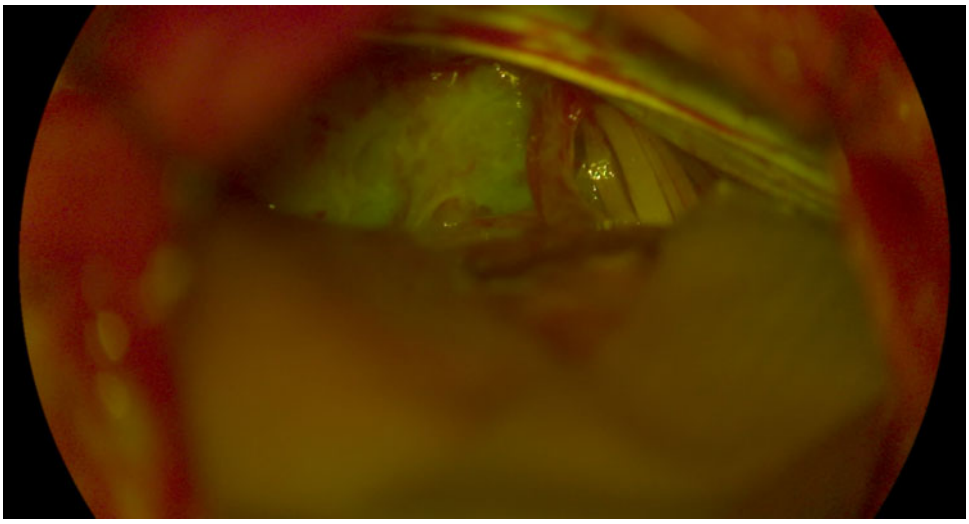
Illuminating Cells May Help Surgeons Remove Nervous System Tumor

Removing a vestibular schwannoma – a slow-growing, benign tumor that develops in the nerves connecting the inner ear to the brain – is a delicate procedure. Surgeons must differentiate the tumor from nearby nerves, arteries, and other intracranial structures.



Sodium fluorescein gives a neon green glow to a vestibular schwannoma.

Research by scientists at the University of Miami Miller School of Medicine has shown that sodium fluorescein, a sodium salt and organic fluorescent dye that makes vestibular schwannoma tumors glow neon green, may help surgeons achieve that differentiation. Their findings, which demonstrate that sodium fluorescein may thus improve the safety and outcomes of

an otherwise complicated brain surgery, were recently published in the journal *Otology & Neurotology*.

Vestibular schwannomas originate from the cochleovestibular nerves, which can affect hearing and balance. These skull base tumors occur in the general population but are particularly devastating when they occur in people with a genetic syndrome called Neurofibromatosis type 2 (NF2). In NF2 patients, vestibular schwannomas can cause deafness in both ears.

Doctors may monitor vestibular schwannomas that are small and asymptomatic. These tumors can also be treated with radiation, depending on their size. In special circumstances, NF2 patients are treated with off-label chemotherapy with the hope of preventing further tumor growth. Surgeons may also remove vestibular schwannomas, especially if they are large, symptomatic, and putting pressure on the brainstem, according to Fred F. Telischi, M.E.E., M.D., the James R. Chandler Chair in Otolaryngology, chair of the Department of Otolaryngology, and professor of neurological surgery and biomedical engineering.

A surgical challenge

“In some cases, it can be difficult to remove all the tumor without causing a neurological deficit like facial paralysis or hearing loss because the tumors can distort the normal anatomy,” said Michael Ivan, M.D., assistant professor of neurological surgery. “The surgery is a delicate operation especially when patients have large tumors, have failed radiation, or have NF2 because these tumors can adhere to the brainstem and surrounding vessels and nerves.”

Miller School researchers are taking the tumors they remove in the operating room and studying them in the laboratory.

“We want to understand what makes vestibular schwannomas grow and resist treatments,” said Christine Dinh, M.D., associate professor of otolaryngology and director of the Schwannoma Laboratory at the Miller School. “We are investigating many aspects of vestibular schwannoma, particularly ways to improve surgery in challenging cases.”

Sodium fluorescein is also used in ophthalmology to look at blood flow to the retina and in neurosurgery to detect glioblastoma, a brain cancer. Miller School researchers wanted to test whether sodium fluorescein could help surgeons visualize vestibular schwannomas and help them distinguish tumor from normal structures nearby.

In an *in vitro* study, sodium fluorescein accumulated preferentially in vestibular schwannoma cells, causing them to glow neon green when stimulated with blue light. Miller School researchers collaborated with University of Central Florida researcher Cristina Fernandez-Valle, Ph.D., a professor of neuroscience.

Clinical trials begin soon

In the recently published paper, Dr. Dinh, its senior author, and colleagues described how they administered sodium fluorescein intravenously, causing vestibular schwannomas to become fluorescent green when blue light was directed toward the tumor. The researchers are ready to take the next step and will soon begin clinical trials with sodium fluorescein in patients undergoing vestibular schwannoma surgery, according

to Dr. Dinh.

“We were amazed at the initial results and will be starting a clinical trial to help us determine the best dosage, timing, and fluorescent filters to better visualize the tumors, protect neurovascular structures, and improve patient surgical outcomes,” Dr. Ivan said.

Other Miller School coauthors include Xue Zhong Liu, M.D., Ph.D., professor of otolaryngology and human genetics, Mikhaylo Szczupak, M.D., an otolaryngology resident, and Olena Bracho, a research associate.
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