MedicalXpress

New technique to map hormone levels in near real-time could help surgeons detect and remove tumors with precision

July 27 2015

As many as 20 percent of people may have a benign cyst or tumor in their pituitary gland. The vast majority of pituitary tumors are noncancerous, but can cause headaches and profound fatigue, and can also disrupt hormone function. Currently, surgeons rely on radiologic images and MRIs to gather information about the size and shape of the tumor, but the resolution of such imaging technologies is limited, and additional surgeries to remove more of the tumor may be needed if a patient's symptoms persist. In a new study published in the *Proceedings of the National Academy of Sciences* on July 27, investigators from Brigham and Women's Hospital (BWH) present a new technique that could help surgeons more precisely define the locations of tumors in near real-time.

The new strategy uses a visualization technique (matrix-assisted laser desorption/ionization mass spectrometry imaging - MALDI MSI) that can analyze specific hormones, including growth hormone and prolactin, in tissue. In the newly published study, the researchers find that it's possible to use MALDI MSI to determine the composition of such hormones in a pituitary sample in less than 30 minutes. This could give surgeons critical information to help distinguish tumor from normal gland.

"Our work is driven by a clinical need: we've developed a test specifically tailored for the needs of our neurosurgeon colleagues," said

corresponding author Nathalie Agar, PhD, director of the Surgical Molecular Imaging Laboratory in the Department of Neurosurgery at BWH. "A surgeon may sacrifice half of the pituitary gland in an effort to get the tumor out. Without a tool to distinguish healthy tissue from tumor, it's hard to know in real-time if the surgery was a success. With this technology, in under 30 minutes a surgeon will be able to know if a sample contains normal pituitary tissue or a pituitary tumor."

"Patients show up with the clinical symptoms of a pituitary tumor, but the tumor itself may not be visible on an MRI," said co-author Edward Laws, MD, director of the Pituitary and Neuroendocrine Center at BWH. "This technique, which maps out where excess concentrations of hormone levels are located, has the potential to allow us to confirm that we've removed the abnormal tissue."

"Evaluating whether a piece of pituitary tissue is abnormal can be challenging on frozen section," said co-author Sandro Santagata, MD, PhD, of BWH's Department of Pathology. "This approach has wonderful potential for enhancing our diagnostic capabilities. It is clearly an important step toward providing intra-operative molecular characterization of pituitary tissues."

To test the technique, the research team analyzed hormone levels in 45 pituitary tumors and six normal pituitary gland samples, finding a distinct protein signature unique to the normal or tumor sample.

Mass spectrometry, a technique for measuring chemicals present in a sample, is currently used in the operating room to help inform clinical decisions, but up until now, the focus has been on small molecules - metabolites, fatty acids and lipids - using a different type of approach. By analyzing proteins, MALDI MSI offers a way to visualize hormone levels.

Current methods used to detect hormone levels take too long to fit the time constraints of surgical intervention. Surgeons must either remove a larger amount of potentially healthy pituitary gland or perform follow up surgery if the tumor has not been fully removed.

"We're hoping that techniques like this one will help move the field toward more precise surgery: surgery that not only removes all of the tumor but also preserves the healthy tissue as much as possible," said Agar.

In the next phase of their work, Agar and her colleagues plan to test out the technique in BWH's AMIGO suite and analyze the impact of the technique on clinical decision making.

More information: MALDI mass spectrometry imaging analysis of pituitary adenomas: Toward the near-real-time delineation of pituitary tumors, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1423101112

Provided by Brigham and Women's Hospital