Surgical technique spots cancer invasion with fluorescence

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One of the greatest challenges faced by cancer surgeons is to know exactly which tissue to remove, or not, while the patient is under anesthesia. A team of surgeons and scientists at University of California, San Diego School of Medicine have developed a new technique that will allow surgeons to identify during surgery which lymph nodes are cancerous so that healthy tissue can be saved. The findings will be published in the January 15 print edition of *Cancer Research*.

"This research is significant because it shows real-time intraoperative detection of cancer metastases in mice," said Quyen T. Nguyen, MD, PhD, associate professor of Head and Neck Surgery at UC San Diego School of Medicine. "In the future, surgeons will be better able to detect and stage cancer that has spread to the patient's lymph nodes using molecules that were designed and developed at UC San Diego."

Lymph nodes, located throughout the body, serve as filters that contain immune cells to fight infection and clean the blood. When cancer cells break away from a tumor, the cells can travel through the lymph system and hide in these tiny organs. Surgeons remove the nodes to determine if a cancer has spread. However, human nodes, only half a centimeter in size, are difficult to discern among the surrounding tissue during surgery. Furthermore, even when surgeons are able to map the location of the nodes, there is no current technique that indicates whether or not the lymph nodes contain cancer, requiring removal of more lymph nodes than necessary.

"With molecular-targeted imaging, surgeons can avoid unnecessary removal of healthy lymph nodes which is better long-term for patients," said Nguyen, director of the facial nerve clinic at UC San Diego Health System. "The range of the surgeon's visual field is greatly enhanced by a molecular tool that can help achieve accurate surgical margins and detection of metastases so that no tumor is left behind."

The fluorescently labeled molecules, known as ratiometric activatable cell-penetrating peptides (RACPP), are injectable. When used in mouse models, surgeons could see where the cancer had spread with high sensitivity and specificity even when the metastatic sites were only a few millimeters in size.

This form of instant pathology is an improvement over traditional sentinel node mapping, whereby only the location of the lymph node is detected without gleaning any information on actual cancer involvement.

Current methods for managing prostate cancer and neck squamous cell carcinoma only reveal the extent of cancer involvement after the patient has undergone surgical removal of all susceptible lymph nodes.

This new technique will decrease OR time because the surgical team need not wait for pathology reports, decrease time under anesthesia, and decrease unnecessary surgery on noncancerous lymph nodes.

Nyguyen's earlier research with Nobel Prize winner Roger Tsien, PhD, professor of pharmacology at UC San Diego School of Medicine, showed in animal models how injectable fluorescent peptides could be used to highlight hard-to-see peripheral nerves, allowing surgeons to avoid them when removing or repairing other tissues.

Provided by University of California - San Diego