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Optical imaging could create pathway for radiotracers, study finds

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A study published in the July issue of The *Journal of Nuclear Medicine* (JNM) reports on investigative research of a novel optical imaging technique called "Cerenkov luminescence imaging (CLI)." According to the authors, the technique could lead to the faster and more cost-effective development of radiopharmaceuticals for the diagnosis and treatment of cancer and other conditions.

"The development of novel multimodality imaging agents and techniques could represent the frontier of research in the field of medical imaging science," said Jan Grimm, M.D., Ph.D., a professor and physician at Memorial Sloan-Kettering Cancer Center and Weill Cornell Medical Center in New York and corresponding author for the study. Grimm explained that his group's work, along with current work from groups at the University of California Davis (Simon Cherry, Ph.D.) and Stanford University (Sanjiv Sam Gambhir, M.D., Ph.D.), may open a new path for optical imaging to move into the clinic.

When light travels through water, its speed decreases. A particle that moves faster than light produces a "shock wave" (much like the sonic boom that broke the sound barrier), which emits a visible blue light known as "Cerenkov radiation." The researchers write that their study is among the first to explore Cerenkov radiation's applications for medical imaging using optical imaging techniques.

Optical imaging is a molecular imaging procedure in which light-producing molecules designed to attach to specific cells or molecules are

injected into the bloodstream and then detected by an optical imaging device. It usually requires either excitation by an external light source or by a biological process. Cerenkov imaging produces the light from the radioactivity, so no external illumination is needed. Combining optical imaging with nuclear medicine presents a new path for imaging medical isotopes, Grimm said. "It provides optical imaging with an array of approved nuclear tracers already in clinical use today, which can be used immediately, as opposed to fluorescent dyes," he added.

For the study, researchers evaluated several radionuclides for potential use with CLI. Researchers used CLI and positron-emission tomography (PET) imaging to visualize tumor-bearing mice. The results show that CLI visualizes radiotracer uptake in vivo. The resulting decrease of light over time correlates with the radioactive decay of the injected tracer.

An added value of this technique is its ability to image radionuclides that do not emit either positrons or gamma rays—a current limitation for nuclear imaging modalities. CLI brings to light isotopes that could not be visualized previously. Additionally, optical imaging techniques show promise for endoscopy and surgery because of the ability to visualize tumor lesions, which could provide real-time information to surgeons and help guide operations.

"The benefits of optical imaging are numerous, and we're on a path to realizing them," said Grimm. "We are optimistic that these new techniques will one day be available to physicians as another tool for the diagnosis and treatment of disease."

More information: "Cerenkov Luminescence Imaging of Medical Isotopes", *Journal of Nuclear Medicine* . jnm.snmjournals.org

Provided by Society of Nuclear Medicine