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Mayo Clinic researchers share latest findings in CT radiation dose reduction efforts

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In recent years, advances in CT scanner technology have made perfusion computed tomography (CT) imaging an important diagnostic tool for patients with suspected stroke. Now, researchers at Mayo Clinic are working to reduce radiation dosages used to acquire perfusion and other CT images. Mayo Clinic medical physicist Cynthia McCollough, Ph.D., and her group of researchers presented their findings related to CT dose reduction at the 52nd Annual Meeting of the American Association of Physicists in Medicine on July 20 in Philadelphia. The presentation was entitled "20-Fold Dose Reduction Using a Gradient Adaptive Bilateral Filter: Demonstration Using in Vivo Animal Perfusion CT."

"We believe in the clinical value of perfusion CT, and though there is no documented risk of injury at the currently prescribed radiation levels, we are trying to lower the dose for the benefit of patients," says Dr. McCollough, diagnostic radiologist, Mayo Clinic.

The As Low As Reasonably Achievable, or ALARA, principle has always guided Mayo Clinic's approach to the dosages of radiation used to acquire CT images. Dr. McCollough's team has been experimenting with a newly created image-processing algorithm that produces high-quality perfusion CTs with up to 20 times less the radiation used under existing protocols. Depending on the diagnostic application, a perfusion CT exam takes about 30 seconds to scan the tissue multiple times after iodine has been injected. This technique detects changes in blood volume and flow that reveal injuries to vessels or a tumor's response to treatment. Information from each consecutive scan is then digitally cross-

referenced with other images taken during the exam to improve image quality and reduce distortions.

Thus far, the new perfusion CT algorithms have proved effective in animal models, and Dr. McCollough's team has begun looking at ways to introduce the methodologies into clinical practice.

"When we use very low doses of radiation to acquire a CT, image graininess can significantly decrease the value of the exam," says the study's first author, Juan Carlos Ramirez Giraldo, Mayo Clinic. "With this new algorithm, we are able to maintain the image quality by cross-referencing it with other images collected during the exam."

In related efforts, using one of the latest CT scanners on the market, Mayo Clinic already has other advanced algorithms as part of its clinical practice. A team of radiologists and physicists have recently implemented a new routine head CT protocol that cuts radiation dose by nearly 50 percent. While the American College of Radiology allows its accredited facilities to use head CT doses up to approximately 75 mGy, Mayo Clinic's newly introduced patient protocol uses a dose of only 38 mGy. This dose reduction is particularly significant as head CT exams are one of the most commonly performed CT procedures.

When asked how the new head CT protocol is changing clinical practice, neuroradiologist
David DeLone, M.D., Mayo Clinic, says, "patients aren't aware that anything has changed, and as radiologists looking at a study, we don't know anything has changed. Yet, we are obtaining high-quality images, more consistently and in shorter times, while exposing patients to about half of the radiation dose. It's a win-win for everyone."

Provided by Mayo Clinic