CHICAGO – Researchers are using artificial intelligence to reduce the dose of a contrast agent that may be left behind in the body after MRI exams, according to a study being presented today at the annual meeting of the Radiological Society of North America (RSNA).

Gadolinium is a heavy metal used in contrast material that enhances images on MRI. Recent studies have found that trace amounts of the metal remain in the bodies of people who have undergone exams with certain types of gadolinium. The effects of this deposition are not known, but radiologists are working proactively to optimize patient safety while preserving the important information that gadolinium-enhanced MRI scans provide.

Enhao Gong, Ph.D.

“There is concrete evidence that gadolinium deposits in the brain and body,” said study lead author Enhao Gong, Ph.D., researcher at Stanford University in Stanford, Calif. “While the
implications of this are unclear, mitigating potential patient risks while maximizing the
clinical value of the MRI exams is imperative.”

Dr. Gong and colleagues at Stanford have been studying deep learning as a way to achieve
this goal. Deep learning is a sophisticated artificial intelligence technique that teaches
computers by examples. Through use of models called convolutional neural networks, the
computer can not only recognize images but also find subtle distinctions among the imaging
data that a human observer might not be capable of discerning.

To train the deep learning algorithm, the researchers used MR images from 200 patients
who had received contrast-enhanced MRI exams for a variety of indications. They collected
three sets of images for each patient: pre-contrast scans, done prior to contrast administration
and referred to as the zero-dose scans; low-dose scans, acquired after 10 percent of the
standard gadolinium dose administration; and full-dose scans, acquired after 100 percent
dose administration.

The algorithm learned to approximate the full-dose scans from the zero-dose and low-dose
images. Neuroradiologists then evaluated the images for contrast enhancement and overall
quality.

Results showed that the image quality was not significantly different between the low-dose,
algorithm-enhanced MR images and the full-dose, contrast-enhanced MR images. The
initial results also demonstrated the potential for creating the equivalent of full-dose,
contrast-enhanced MR images without any contrast agent use.

These findings suggest the method’s potential for dramatically reducing gadolinium dose
without sacrificing diagnostic quality, according to Dr. Gong.

“Low-dose gadolinium images yield significant untapped clinically useful information that
is accessible now by using deep learning and AI,” he said.

Now that the researchers have shown that the method is technically possible, they want to
study it further in the clinical setting, where Dr. Gong believes it will ultimately find a home.

Future research will include evaluation of the algorithm across a broader range of MRI
scanners and with different types of contrast agents.

“We’re not trying to replace existing imaging technology,” Dr. Gong said. “We’re trying to
improve it and generate more value from the existing information while looking out for the
safety of our patients.”

Co-authors are Jonathan Tamir, B.Sc., John Pauly, Max Wintermark, M.D., and Greg
Zaharchuk, M.D., Ph.D.

Dr. Gong received an RSNA “Trainee Research Prize – Resident” award for his research.

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For patient-friendly information on contrast materials, visit RadiologyInfo.org.