Risk reduction

Efforts to reduce radiation exposure increase as awareness grows

By Jaimy Lee
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Several years ago, a physician at Scripps Health launched a pilot program that used a patient’s body mass index to measure dose for a computed tomography scan.

Using BMI to compute dose reduces the patient’s radiation dose by up to 50% and is one method the San Diego-based health system is using to cut the radiation dose from CT scans, according to Dr. John Johnson, chief of CT imaging at Scripps Mercy Hospital, a 439-bed facility that is part of the Scripps Health system.

“One strategy is to re-engineer all of the CT protocols from standard protocols to low-dose protocols,” he says.

A growing awareness about the risks of diagnostic imaging, in particular with CT, in recent years has generated discussion among hospital executives, radiologists, manufacturers, government agencies and patients about overall use of CT scans in the U.S.

Johnson says two years ago, it would have been difficult to locate a medical journal article that addressed radiation risk reduction. Last year, the Food and Drug Administration held a hearing and announced the results of an investigation in reported radiation overdoses that occurred from 2008 to October 2010 at hospitals in California and Alabama. The agency and the Centers for Disease Control and Prevention later released reports about diagnostic imaging.

More recently, the Joint Commission issued a Sentinel Event alert that noted the U.S. population’s total exposure to ionizing radiation has almost doubled in the past 20 years and recommended new actions for hospitals.
In California, where 260 patients at Cedars-Sinai Medical Center in Los Angeles were exposed to radiation doses that were about eight times the expected level during a nearly two-year period, the first phase of a law that requires providers to record CT radiation doses and receive state accreditation goes into effect Jan. 1. The patients had been undergoing CT brain perfusion scans.

“It's not just making sure that it's the right amount, but whether that test is necessary, that number of tests is necessary, and whether there are alternative methods,” says Dr. Robert Wise, medical adviser to the division of healthcare quality evaluation at the Joint Commission.

The Joint Commission alert, issued in August, made a number of recommendations for providers. They include: using ultrasound or MRI when similar imaging quality can be produced; adhere to guidelines set by the Nuclear Regulatory Commission, the Society for Pediatric Radiology, the American College of Radiology and the Radiological Society of North America; ensuring the proper dosing protocol is in place; establishing effective processes and protocols; evaluating the safety of equipment; and establishing a culture of safety and expanding the radiation safety officer's role to include patient safety and education of dosing and equipment usage for physicians and technologists.

The commission also said in the alert that it endorses the creation of a national registry that tracks radiation doses, such as the one established by the ACR earlier this year; encourages manufacturers to implement dose safeguards into equipment; and supports regulations that eliminate avoidable imaging and monitor appropriate use of self-referrals.

The ACR, which has offered a CT accreditation program since 2002, launched its national dose registry in May.

As of Oct. 31, 164 outpatient and inpatient facilities have enrolled in the registry and more than 300,000 exams have been registered, says Pamela Wilcox, the ACR's assistant executive director of quality and safety. The Dose Index Registry gathers anonymized dose information from CT scans, allowing facilities to compare their CT dosage with other sites and national benchmarks.

The registry “helps imaging providers gauge how effective their dose optimization efforts are by continuously supplying measurement of their dose over time,” said Dr. John Patti, chair of the ACR's board of chancellors, in a news release at the time of the registry's launch.

The registry gathers data ranging from the names of the manufacturer and the institution to the patient's sex, age and weight. Healthcare facilities that participate in the registry pay an annual fee based on the number of practicing radiologists at a given site, as well as a one-time $500 registration fee.

Stephen Steuterman, radiation safety officer at Scripps Health, says the system is
evaluating participation in the ACR registry. Scripps Health's decision includes input from the system's information systems staff because it would be sharing patient data, he adds.

The Joint Commission's Sentinel Event alert and the ACR accreditation policies both push for increased education and training of radiology staff. In previous incidents, such as the one at Cedars-Sinai, the FDA found that although the machines were functioning properly, improper use had allowed for the increased doses of radiation. In some cases, patients have received multiple scans in an effort to get a scan with better image quality.

“Sometimes in the course of the really hectic busy day that technologists and radiologists have, they're not always as cognizant of image quality as they need to be” on the first try, Wilcox says.

**Not just a department issue**

The goal of the safety recommendation encourages both radiology departments and hospital executives to address the issue of dosage. Wise says providers should address radiation dose protocols in a similar manner to how hospitals and health systems view healthcare-associated infections—as an issue for the hospital, not just a department.

Wise also notes that some of the Joint Commission's recommendations may come with a price tag. Some actions could require the acquisition of different machines, additional training or increased pay for technicians.

“There is significant cost associated with improving the culture,” he says.

Government data have shown a steady increase in use through much of the last decade although recent data shows declines in CT use. A CDC report released in 2010 showed that MRIs, PET and CT scans tripled between 1996 and 2007. Annual emergency room visits that included CT scans increased from 2.7 million in 1995 to 16.2 million in 2007, according to a study published in the November issue of Radiology.

But Johnson and Steuterman say CT scan use has dropped in recent years—Scripps Mercy Hospital reported that CT scans decreased from 51,222 in 2006 to 48,903 in 2010—a decline they attribute in part to the recession and growing patient awareness about radiation exposure. A recent Medical Imaging & Technology Alliance analysis found that the portion of total Medicare claims payments devoted to imaging dropped 24.9% from 2006 to 2010.

The risks of radiation may include immediate signs such as hair loss or skin redness, but
excessive radiation exposure also can put a patient at risk for cancer. The Joint Commission said the 72 million CT scans performed in 2007 could lead to 29,000 future cancers and 14,500 future deaths due to the radiation. The ECRI Institute, a not-for-profit organization that researches patient safety, listed “exposure hazards from radiation therapy and CT” as one of its top 10 health technology hazards for 2012 (Nov. 7, p. 18). “CT is a particular concern because it's being used more and more often and because it has a relatively high dose: It alone contributes about 50% of the entire radiation dose from artificial sources,” said the ECRI report.

Wise says physicians use CT because the imaging is better quality, the machines are efficient—especially for teams that handle high-volume patient levels—and scans can be easily read and sent to an outside facility. Well before the Joint Commission's recommendations, some providers began to implement protocols that reduced the dose while allowing access to CT scanners.

Dr. William Shuman, director of clinical radiology at the University of Washington Medical Center, says the Seattle-based academic medical center implemented a program four years ago to reduce CT dose and now operates in a 60% to 70% reduced-dose range.

Although the University of Washington had purchased new scanners with greater dose control capabilities around the time the program was implemented, Shuman says several small techniques have dramatically reduced radiation dose, including ensuring that a patient is properly positioned in the center of the machine and using lead aprons and breast and thyroid shields. He says the radiology team was surprised by how much they "could reduce the dose with a bit of attention."

The radiology team also uses a technique called iterative reconstruction, which takes raw data produced by scanners and turns it into an image. This allows the radiologist to reduce the noise in an image, as well as the dose, although it produces a less attractive image, says Shuman, who calls the technique the “biggest single innovation” for supporting radiation dose reduction. A study published in 2009 in the American Journal of Roentgenology found that radiologists can reduce patient radiation from a CT scan by up to 65% by using adaptive statistical iterative reconstruction.

All University of Washington patients who receive CT are scanned by this technique, which Shuman says has dropped radiation dose by an overall 40%.

General Electric Co., Hitachi, Philips, Siemens and Toshiba, the manufacturers that produce the majority of the CT scanners in the U.S., announced in 2010 that they would add an alert feature and a warning feature to CT equipment as part of a “dose check” initiative.

A year ago, Philips Healthcare launched iDose4, an iterative reconstruction technique the company says can increase resolution by 50% while also reducing dose, and it continues to educate physicians and healthcare professionals about how to get the minimum amount
of dose for the maximum amount of return, says Gene Saragnese, general manager and CEO of Philips Healthcare's imaging systems business.

"It's been our philosophy all along to minimize that amount of dose and to maximize the clinical information available," he says.

The FDA granted GE Healthcare's model-based iterative reconstruction technology 510(k) clearance in September. Like Philips and other CT scanner manufacturers, the company has developed new technology as well as upgrades for existing technology that provide capabilities to lower dose.

"We're seeing tremendous interest in the low-dose offerings that we have available, when people buy new equipment or replace older equipment," says Steve Gray, vice president and general manager of the CT and Advantage Workstation unit at GE Healthcare. "Dose is a primary buying factor."