

Protecting the Patient: A New Approach to Imaging



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CT is an unrivaled imaging modality, dramatically impacting the delivery of health care in the later portion of the 20th century and it likely will continue to do so in the current century.

Unfortunately, CT uses ionizing radiation in doses that far exceed those encountered with many other common imaging methods. Thus, the potential risk versus benefit ratio always must be carefully examined. The potential risk of exposing otherwise asymptomatic patients to higher levels of radiation via CT screening and through multiple repeat studies has become an often-discussed issue. Radiologists and nonradiologists alike must team together to minimize patient exposure to these higher levels of radiation, the potential risks of which remain uncertain.

“It is no secret that the utilization of CT services have dramatically increased since the introduction of the multidetector scanners, allowing us to almost instantaneously evaluate anatomic structures and pathologic processes that heretofore were not possible,” said Mark S. Parker, MD, Associate Professor of Diagnostic Radiology and Internal Medicine at the Medical College of Virginia Hospitals—VCU Health System in Richmond and an advocate for closer dosage supervision. “There is a growing amount of literature examining this issue simply because these increased levels of patient radiation dose cannot be dismissed for the well-being of our patients.”

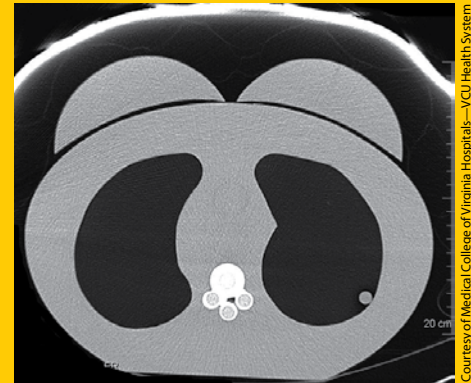
In a study published in the *American Journal of Roentgenology*, “Female Breast Radiation Exposure during CT Pulmonary Angiography” (Parker MS, et al. *AJR* 2005; 185:1228–1233), Parker concluded CT pulmonary angiography delivers a minimum radiation dosage to the average-sized woman that “greatly exceeds the American College of Radiology recommendation...for standard two-view mammography.”

“The potential latent carcinogenic effect of such radiation exposure at this time remains unknown,” he wrote. “We encourage the judicious use of CT pulmonary angiography and lower doses of ionizing radiation and nonionizing radiation alternatives when appropriate.”

Like many of his colleagues, Parker said ...“the increased utilization of CT services warrants close scrutiny. We want our patients confident that each and every diagnostic study employing the use of ionizing radiation is justified and in their best medical interest.”

Multiple Challenges, Straightforward Solutions

Parker agrees with most radiologists that there are many challenges ahead that must be faced to protect patients from these higher levels of radiation and overcoming most of the challenges start with straightforward, commonsense solutions, beginning with re-educating health care professionals. But who needs more educating—radiologists or nonradiologists? Parker’s emphatic response: “Both.”



Investigational shielding products, such as the one shown in this CT of a custom-designed phantom, have been developed by Mark S. Parker and his colleagues in conjunction with Computerized Imaging Reference Systems, Inc. and Worldwide Innovations & Technologies, Inc. to conduct tests on potential loss in lesion conspicuity created by external shields.



For more information on protecting patients from excessive radiation exposure, please visit the ARRS PQI Web site at pqi.arrs.org/documents/ps_summer2007.pdf.

In many instances, Parker suggested, the dilemma is an “in-house” issue with “many radiologists and nonradiologists alike simply being unfamiliar with the radiation doses associated with various diagnostic imaging studies.”

“Appropriate or tailored CT utilization and the radiation doses associated with studies are being stressed more and more to our current generation of diagnostic radiology residents, who will eventually become the advocates of the medical profession, educating our non-radiology colleagues and patients themselves,” Parker said.

Parker stressed there should be collaboration between consulting radiologists and referring clinicians managing a patient’s medical condition as to which study may be in the patient’s best interest, noting that “in some cases CT may not be the best option and studies using lower doses of radiation, such as a V/Q scan, or non-ionizing radiation alternatives, such as MR or ultrasound, may be equally efficacious.” He further stressed the need for active collaboration when dealing with younger patients who may already have undergone multiple CT examinations previously.

While there are fundamental steps to minimize dosages, such as reducing tube current, tube voltage, or exposure time, each action potentially compromises the diagnostic information needed for interpretation. There must be a balance between dose reduction and acceptable imaging results necessary for diagnosis.

However, asking radiologists to step up and take the lead in educating colleagues on this critical issue is not as easy as it sounds.

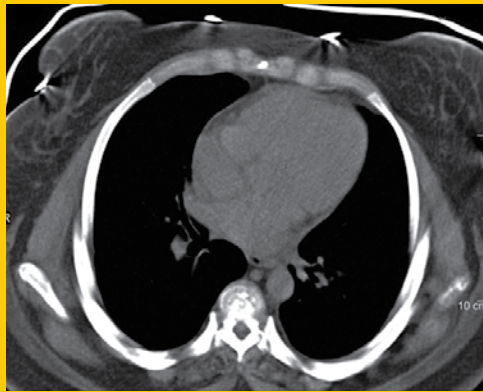
“I suspect many radiologists may be uncomfortable educating their clinical colleagues on this issue,” Parker surmised. “But it isn’t difficult—we need to start by pointing to the data that support what we’re saying.”

“The key is to make everyone involved in the patients’ care aware of the importance of radiation dose,” Parker continued. “We simply must use common sense when it comes to the larger picture and ask if another imaging modality would provide us with answers we need rather than routinely ordering another CT scan.”

Facts, Not Fear

Parker emphasized “CT is a tool and, like any tool, it works best when used for the right purpose.” He also urged nonradiologists and radiologists to discuss the purpose of the CT, what is hoped to be gained by it, and the potential downsides with patients directly. Patients should have choices of alternative imaging procedures, if appropriate, and be actively involved in the decision process.

“We don’t want patients scared about undergoing a truly indicated and medically necessary CT, but they need to have an active say-so in the process,” he said. “Patients are already more aware of this issue through the news media and other misinformed avenues and many of them are confused by the sensational and inaccurate flood of misleading information they’re seeing on radiation exposure from CT scans.”



Courtesy of Medical College of Virginia Hospitals—VCU Health System

An axial CT image shows a patient protected by a commercially available bismuth breast shield. A similar shield being developed by Parker and his colleagues is not yet commercially available, but he said he hopes it will be soon.

“We must determine how we can address their questions and tackle this issue head on,” Parker added. “We need to make sure patients have the facts from those who are most knowledgeable on the subject. That is, their physicians.”

These conversations also may include the possible use of shielding to reduce absorbed radiation dose to radiosensitive tissues (e.g., eye, thyroid, and breast) that are not under direct investigation, but subjected to increased doses because of their superficial anatomic location and proximity to the field of view under study. Bismuth shields, marketed under the trade name AttenuRad, are commercially available for such purposes (F & L Medical Products, Vandergrift, Penn.). In fact, Parker’s facility employs the use of a bismuth breast shield on female patients. Additionally his is one of a few institutions currently focusing their efforts on breast shielding during CT. As a result, Parker and his colleagues are developing a custom-designed breast shield that on preliminary phantom studies has reduced absorbed radiation dose to the female breast during chest CT by 56–61% (*Clin Radiol* 2008; 63:278–288).

The tungsten-antimony, lead-free shield (Worldwide Innovations & Technologies, Inc., Overland Park, Kan.) is designed to drape across the patient, and to be lightweight, comfortable, easily disinfected, and reusable, but is still undergoing further testing. Parker said that since his institution began routinely using the bismuth shield, he has received numerous inquiries from across the country about his institution’s breast shield policy, techniques, and how to acquire the commercially available bismuth shield.

Yet, talking with patients about imaging procedures and minimizing exposure to radiation represent only the start of a new approach. Many radiologists agree that the cumulative dosages patients incur with diagnostic imaging using ionizing radiation should be recorded in their medical record to alert physicians when a patient might be nearing “higher” levels of radiation exposure (i.e., 100 mSv).

“First do no harm” is the basic tenet of the Hippocratic Oath that all physicians, radiologists, and nonradiologists take and apply to patient care. Moreover, Parker maintains that radiologists must extend the ALARA principle (as low as reasonably achievable) to the optimal delivery of health care to their patients. This can best be achieved, he noted, through the education of radiologists and non-radiologists unfamiliar with the higher levels of radiation dose and by involving patients in their care and diagnostic management. ■