JAOA EDITORIAL

Imaging Gently: A Call for Awareness

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Since publication of a study by Brenner and colleagues in the *American Journal of Roentgenology*[1] about 10 years ago, concern about possible induction of added cancers due to patient exposure to ionizing radiation from medical imaging—particularly computed tomography (CT)—has continued to grow.[2,3] Increasing concern by the public and health care providers alike about overuse of medical imaging and the appreciation of the potential for excessive patient exposure has prompted reassessment of the use of these critical patient care tools.

Of particular concern is that pediatric patients may be exposed to excessive and sometimes unnecessary ionizing radiation associated with medical imaging. Children are up to 10 times more susceptible to potential radiation-induced toxicities for several reasons.[1] The younger the child, the more radiation-sensitive are their developing tissues.[4,5] Children have a longer expected lifetime during which adverse sequelae such as radiation-induced cancers, cataracts, and marrow suppression may manifest. Compared with adults, children's small size and typically low percentage of body fat, especially in very young patients, allow increased absorption of the radiation beam.[5] Do these concerns mean that CT, radiography, and fluoroscopy should be abandoned? Of course not. Results from these tests provide information critical to the care of patients. However, as with any drug, imaging should be used only for appropriate indications and should be *sized* for the patient.[5-9]

In response to these concerns, the Society for Pediatric Radiology, led by Marilyn Goske, MD, spearheaded the organization of the Alliance for Radiation Safety in Pediatric Imaging—or the Image Gently Alliance—in 2007. The goal of the Alliance is straightforward: to change practice, and to raise awareness of the opportunities to lower radiation dose in the imaging of children.[7,10-12] Notably, the founding organizations represented a wide spectrum of health care providers whose roles related to medical imaging: the Society for Pediatric Radiology, the American College of Radiology, the American Society of Radiologic Technologists, and the American Association of Physicists in Medicine. Supporting groups have expanded the initiatives even more broadly to include equipment manufacturers, governmental agencies, multiple disciplines, and international societies; now numbering 69 organizations (including the American Osteopathic College of Radiology), these groups are working together to improve patient care through medical imaging while controlling patient exposure to ionizing radiation.[10] In other words, this large international multidisciplinary alliance is working to promote the principles of using radiation doses in medical imaging that are As Low As Reasonably Achievable (ALARA) while obtaining critical diagnostic information.

Numerous publications address methods for limiting patient exposures to ionizing radiation while obtaining diagnostic quality studies. However, evidence-based usage of imaging often lags behind incorporation of techniques into the clinical arena. Further, children and adolescents are often imaged using adult techniques. Examinations frequently lack tailoring for their age and size, risking exposure of pediatric patients to excessive and potentially unnecessary radiation.

Investigations are now emerging to guide imaging usage as applicable to a given clinical scenario. One such example is evidenced by numerous studies addressing the diagnosis of appendicitis in pediatric patients and the roles and limitations of imaging in these patients.[13-22] Unlike the clinical presentation in adults, the clinical diagnosis of appendicitis in children is oftentimes "atypical." To improve diagnostic accuracy, several pediatric-specific scoring systems that have been devised[23,24] and evaluated[25] incorporate clinical signs and symptoms with laboratory values. Patient demographics and imaging findings may then be used to augment decision making. Because of the difficulty in diagnosing appendicitis in the pediatric population, imaging assessment may be used to optimize diagnostic accuracy, minimize misdiagnosis, and curtail "negative appendectomy rates."[26,27]

In this month's issue of *JAOA—The Journal of the American Osteopathic Association*, Anandan and Marino[28] report the findings from their investigation of the usage patterns of abdominal-pelvic CT and ultrasonograhy when assessing pediatric patients in whom appendicitis was clinically suspected. During the 3-month study period, 36 pediatric patients aged 8 to 22 years were identified who had surgical proof of appendicitis. Using a modification of the Samuel scoring system,[23] the authors retrospectively correlated imaging findings with surgical findings and through med-

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ical record review sought whether or not imaging impacted clinical decisions. Thirty-three of the 36 patients who made up the study cohort underwent CT evaluation; 30 of those CT evaluations were ordered by the emergency department of a large regional teaching hospital. In none of the medical records were the authors able to identify a comment indicating that results of imaging critically impacted patient care.[28]

Although the study is limited by the small retrospectively assessed patient cohort, it highlights the responsibility of health care providers to critically assess diagnostic schema, re-evaluate limitations and strengths of imaging, and assess strategies for imaging use in patient care. Specifically related to ALARA principles, such an exercise provides an opportunity to raise awareness of potential risks associated with pediatric patient exposure to ionizing radiation from medical imaging and prompts us to critically consider alternate approaches to patient assessment.

In the future, the diagnosis of appendicitis may use a combination of clinical assessment, ultrasonography, and magnetic resonance imaging (MRI), obviating any patient exposure to ionizing radiation. Preliminary reports on the use of MRI in children show promise and adhere to ALARA principles.[29-32] As MRI techniques evolve, sequences become faster, and MRI availability becomes more universal, its utility might expand.

Thus, MRI may modify the use of CT in evaluating cases in which findings from clinical assessment and ultrasonography are inconclusive.

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