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COMMENTARY

Image Gently: improving health literacy for parents about CT scans for children

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Introduction

In a pivotal report issued in 2004 (*Health Literacy: A Prescription to End Confusion*), the Institute of Medicine discussed the critical need for improved health literacy for the 90 million American adults who have difficulty understanding basic health information. Health literacy is defined as "the degree to which individuals have the capacity to obtain, process, and understand basic information and services needed to make appropriate decisions regarding their health" [1]. The report indicates that "over 300 studies have shown that health information cannot be understood by most people for whom it was intended." This report stressed the need for a concerted effort by all stakeholders to improve educational opportunities for patients and their families.

Patients often have a poor concept of the radiation dose and risk associated with CT [2]. In a study by Larson et al. [3], only 13% of parents understood that there is a theoretical risk that the radiation associated with CT might increase the risk of cancer. Some experts believe that parents may contribute to the increasing demand for CT as they seek rapid diagnosis and decision making without understanding the potential risks [4]. The purpose of this commentary is to discuss the importance of informing caretakers of children undergoing CT examinations about the potential radiation risk and describe some educational tools, developed by the Alliance for Radiation Safety in Pediatric Imaging, that are now available for hospitals, practices, and parents on the Image Gently and American Academy of Pediatrics (AAP) websites.

CT is an invaluable diagnostic and management planning tool for health-care providers treating children and adults [5]. Since its introduction in the 1970s, CT use has risen from 2 million studies per year to over 65 million with 7 million CT scans obtained in children in 2007 [6]. The potential radiation risk from CT scans is receiving considerable attention in both the medical literature and lay press [7–11]. The effect of low-level radiation remains controversial with data supporting several differing perspectives [12–15]. Some leading experts propose that low-level radiation has no effect (that there is a threshold below which no harm occurs). Many scientific organizations and experts, however, advocate that radiation even at low levels has a harmful effect and support the concept of a linear, no-threshold model for ionizing radiation risk of cancer induction [16–20]. Because of decreased body fat, increased radiosensitivity and longer life expectancy, children are at increased risk [21–23]. As the true risk from low-

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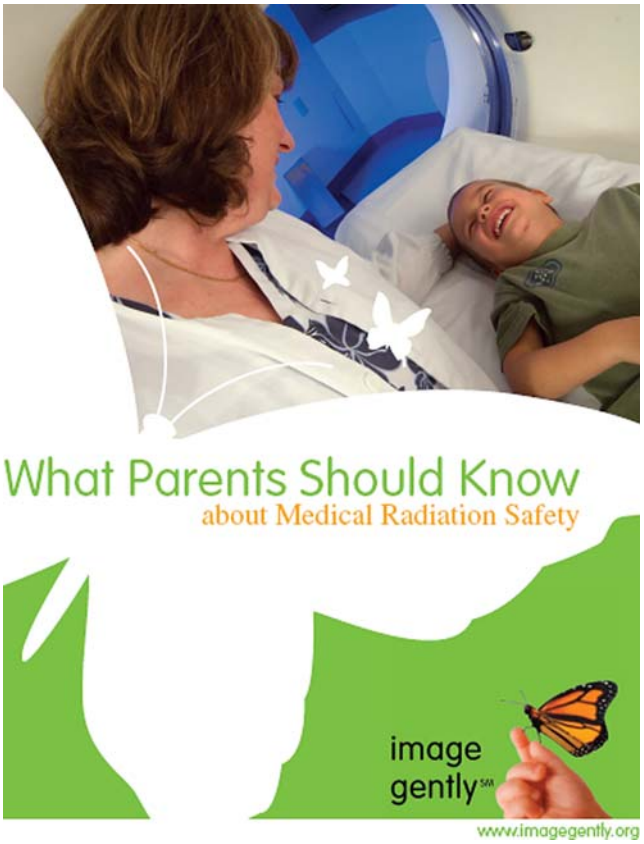

Fig. 1 Parent information pamphlet long version available on www.imagegently.org

level radiation remains unknown, it is prudent to perform CT examinations that are medically justified using the lowest dose scanning parameters that provide a diagnostic study, or to substitute non-radiation imaging modalities where possible. As physicians and physicists attempt to better understand the safety issues of medical radiation, particularly in children, the question as to how best to inform parents about this complex issue is raised.

Radiation dose is a complex topic. Radiation can be measured in many ways—by exposure, by dose equivalent, or by absorbed dose for the whole body or individual organs. Estimating doses for even the same category of study can be misleading and comparing estimated doses for different examinations is not easily standardized [24]. Thus, calculating a dose at which a patient is truly at risk is not feasible. Information about CT scan dose challenges medical physicists, radiologists and radiologic technologists. With experts finding it difficult to agree on dose risk and standardization, how can this complex and controversial topic be translated into information parents can understand?

Some authors suggest that radiation exposure should not be an issue for patients and parents because of the lack of consensus between experts on how to measure radiation dose and assess actual radiation risk [21, 25, 26]. There is a concern that parents may be unnecessarily frightened by information discussing potential radiation risk and may be reluctant to allow their children to undergo CT in instances when a CT scan is truly appropriate.

Assuming that patients or their families are not up to the task of assessing risk, however, may be patronizing [27]. Parents have a right to participate in decisions about the benefits and risks of their child's medical management. A study performed by Larson et al. [3] demonstrated that a brief informational handout regarding CT-associated dose and risk improved parental understanding without changing their willingness to allow their children to undergo non-emergent CT examinations [3]. The handout used in the study provided parents with quantitative information regarding CT-related radiation dose and potential risk. The study demonstrated that the handout only slightly raised parents' level of concern. No parents refused to have their child undergo a CT scan after reading the information.

Parents have access to a huge quantity of information of varying quality. Risks generated by a trusted source are better accepted than those generated by an unknown or untrusted source [27]. Thus, if the topic is not brought up during the time of the examination, the family may feel

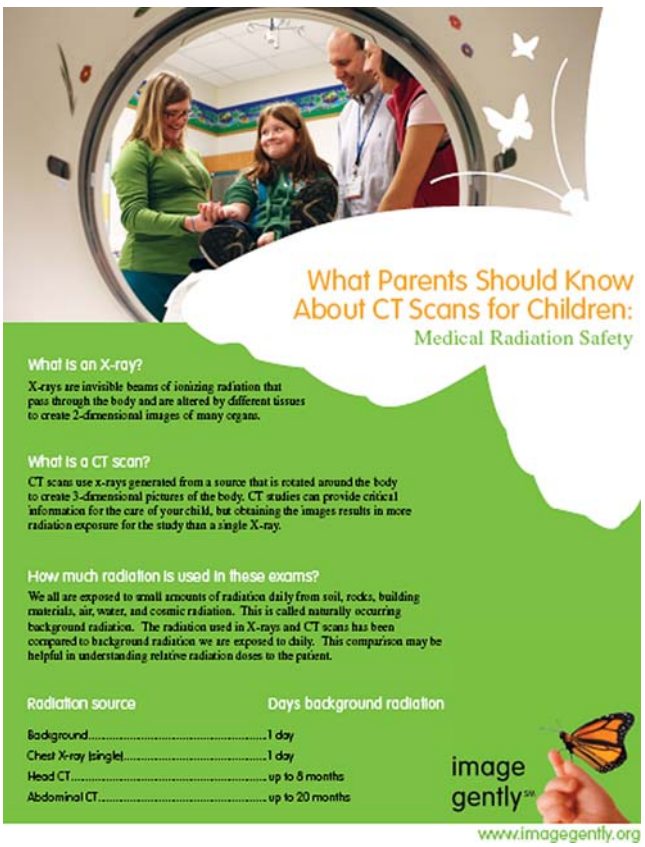

Fig. 2 Parent information pamphlet short version available on www.imagegently.org

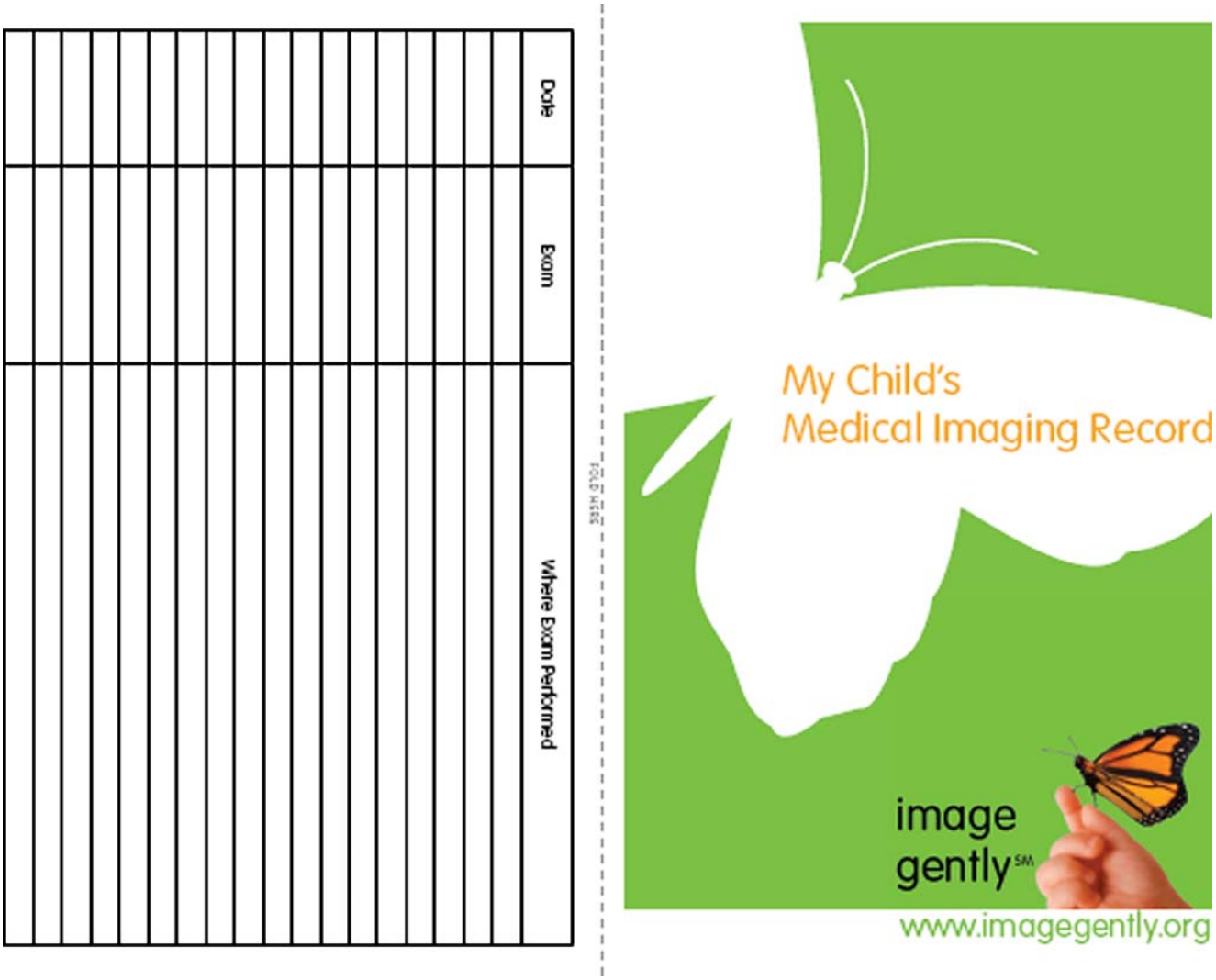

Fig. 3 Medical imaging record available on www.imagegently.org

misinformed and distrustful if they come across risk information at a later date. Getting families involved in these discussions can help foster trust by showing that the radiologist takes their point of view seriously [28]. By providing information up-front, parent/patient autonomy is respected [29].

Studies have shown that referring doctors, including emergency physicians and surgeons, as well as parents, typically underestimate CT-related radiation dose and the associated risk of cancer [30–32]. With the dramatic increase in the number of CT examinations over the past 10 years, there is concern that some pediatric CT examinations either are unlikely to benefit the individual or could be replaced by a nonionizing imaging technique [33]. With education and ongoing interactions between radiologists, scientists and clinicians, it has been shown that inappropriate use of CT in children can be decreased [34–36].

New resources: the Image Gently parent brochure and X-ray Record Card

There has been limited information for parents regarding CT-related radiation risk and even less work to make the information easily available to parents. Several articles targeted at medical professionals discuss the controversies regarding radiation safety [37–39], but there are minimal resources written for parents. The complexities of the issue and continued debate amongst experts make physicians hesitant to discuss the topic with families. The guiding principle of the Alliance for Radiation Safety in Pediatric Imaging, a 33-member organization consisting of leading medical societies, agencies, and regulatory groups, is to impact patient care and change practice through an educational and awareness campaign. This collaborative campaign represents over 500,000 health-care professionals promoting appropriate and high-quality imaging for chil-

dren. The limited resources available for pediatricians and families have spurred the Alliance to develop educational materials in collaboration with pediatricians, directed specifically to parents. This outreach includes downloadable information packets for parents and pediatricians available on www.imagegently.org and www.aap.org. On the Image Gently website, two versions of a parent information packet are available. The longer version entitled "What Parents Should Know about Medical Radiation Safety" (Fig. 1) provides detailed information about medical imaging and relative risk data. The shorter version is a single two-sided colorful sheet titled "What parents should know about CT scans for children" that can be distributed to waiting rooms in emergency and radiology departments (Fig. 2).

The AAP, a partner in the Alliance, provided a grant for the production of a brochure for parents concerning CT imaging for pediatricians to distribute in their offices. Information for parents and pediatricians has also been placed in the Parenting Corner and radiology section on www.aap.org with direct links to the Image Gently website.

Many European nations encourage their citizens to track the number of radiologic studies to which they are exposed. This helps inform their doctor of recent similar examinations, helping decide if an examination is truly necessary. In 1999, the FDA's Center for Devices and Radiological Health (CDRH) consumer information website added an X-Ray Record Card to keep track of when and where a patient's radiographs were taken (www.fda.gov/cdrh/consumer/xraybrochure.html). While tracking actual estimated absorbed doses per study is currently not feasible, tracking the number of examinations and location where the images are stored can be helpful in alerting families and their care providers to the issue of radiation safety. Similar to an immunization record, recording where and when a study was performed, particularly when medical care is provided by a variety of physicians/ emergency rooms/ hospitals, can help decrease the number of repetitive examinations. The www.imagegently.org website has created a colorful downloadable medical imaging record in two sizes, including one that is wallet sized, to track these data (Fig. 3).

Conclusion

Radiologists should want to increase the health literacy of their patients. Image Gently is an educational and awareness campaign that has developed several educational tools for parents and physicians in an effort to increase information availability concerning potential radiation risk. Medical practices and hospitals are encouraged to use these free resources.

CT imaging remains a very valuable diagnostic and management tool that is known to improve health outcomes when used appropriately. Shared decision making with families and pediatricians, including the benefits versus risks of CT, will optimize its use in the health care of children.

References

1. Institute of Medicine of the National Academies (2004) Health literacy: a prescription to end confusion. National Academies Press, Washington, D.C.
2. Lee CI, Haims AH, Monico EP et al (2004) Diagnostic CT scans: assessment of patient, physician, and radiologist awareness of radiation dose and possible risks. Radiology 231:393–398
3. Larson DB, Rader SB, Forman HP et al (2007) Informing parents about CT radiation exposure in children: it's OK to tell them. AJR 189:271–275
4. Linton OW, Mettler FA Jr (2003) National conference on dose reduction in CT, with an emphasis on pediatric patients. AJR 181:321–329
5. Fuchs VR, Sox HC (2001) Physicians' views of the relative importance of thirty medical innovations. Health Aff (Millwood) 20:30–42
6. Smith-Bindman R, Miglioretti D, Larson EB (2008) Rising use of diagnostic medical imaging in a large integrated health system. Health Aff (Millwood) 27:1491–1502
7. Brenner DJ, Hall EJ (2007) Current concepts – computed tomography – an increasing source of radiation exposure. New Engl J Med 357:2277–2284
8. Haaga JR (2001) Radiation dose management: weighing risk versus benefit. AJR 177:289–291
9. Rogers LF (2002) Dose reduction in CT: how low can we go? (editorial). AJR 179:299
10. Sternberg S (2001) CT scans in children linked to cancer later. USA Today, 22 January
11. Zarembo A (2008) CT scans can be better medicine for doctors than for patients. Los Angeles Times, 7 September
12. Linton OW, Mettler A Jr (2005) National conference on dose reduction in CT with an emphasis on pediatric patients. AJR 184:655–657
13. Cohen DL (2002) Cancer risks from low-level radiation. AJR 179:1137–1143
14. Health Physics Society (1998) Radiation risk in perspective: position statement of the Health Physics Society. In: Health Physics Society Directory and Handbook 1998-1999. Health Physics Society, McLean, VA, p 239
15. Kondo S (1993) Health effect of low level radiation. Medical Physics, Madison, WI, pp 85–89
16. Brenner DJ, Elliston CD, Hall EJ et al (2001) Estimated risks of radiation-induced fatal cancer from pediatric CT. AJR 176:289–296
17. Brenner DJ, Doll R, Goodhead DT et al (2003) Cancer risks attributable to low doses of ionizing radiation: assessing what we really know. Proc Natl Acad Sci USA 100:13761–13766
18. Pierce DA, Preston DL (2000) Radiation-related cancer risks at low doses among atomic bomb survivors. Radiat Res 154:178–186
19. National Academy of Sciences (2005) Health risks from exposure to low levels of ionizing radiation: BEIR VII phase 2. NAS, Washington, D.C
20. UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation). Sources and effects of ionizing radiation. UN publication E.94.IX. 2. United Nations, New York, NY

21. Brenner DJ (2002) Estimating cancer risks from pediatric CT: going from the qualitative to the quantitative. Pediatr Radiol 32:228–233; discussion 242–244
22. Chodick G, Ronckers CM, Shalev V et al (2007) Excess lifetime cancer mortality risk attributable to radiation exposure from computed tomography examinations in children. Isr Med Assoc J 9:584–587
23. International Commission on Radiological Protection. 1990 recommendations of the International Commission on Radiological Protection. ICRP publication 60. Pergamon, Oxford, England
24. Huda W, Vance A (2007) Patient radiation doses from adult and pediatric CT. AJR 188:540–546
25. Wall BF (2003) What needs to be done about reducing patient doses from CT? The North American approach. Br J Radiol 76:763–765
26. Levatter RE (2005) Radiation risk of body CT: what to tell our patients and other questions (letter and reply). Radiology 234:968–970
27. Gunderman RB, Applegate KE (2005) Managing risk: threat or opportunity. AJR 185:43–45
28. McCallum DB, Hammond SL, Covello VT (1991) Communicating about environmental risks: how the public uses and perceives information sources. Health Educ Q 18:349–361
29. Earnest F, Swensen SJ, Zink FE (2003) Respecting patient autonomy: screening at CT and informed consent. Radiology 226:633–634
30. Lee CI, Haims AH, Monico EP et al (2004) Diagnostic CT scans: assessment of patient, physician, and radiologist awareness of radiation dose and possible risks. Radiology 231:393–398
31. Thomas KE, Parnell-Parmley JE, Haidar S et al (2006) Assessment of radiation dose awareness among pediatricians. Pediatr Radiol 36:823–832
32. Rice HE, Frush DT, Harker MJ et al (2007) Peer assessment of pediatric surgeons for potential risks of radiation exposure from computed tomography scans. J Pediatr Surg 42:1157–1164
33. Society of Pediatric Radiology (2002) The ALARA concept in pediatric CT intelligent dose reduction. Multidisciplinary conference organized by the Society of Pediatric Radiology. Pediatr Radiol 32:242–244
34. Donnelly LF (2005) Reducing radiation dose associated with pediatric CT by decreasing unnecessary examinations. AJR 184:655–657
35. Linton OW, Mettler FA Jr (2003) National conference on dose reduction in CT, with an emphasis on pediatric patients. AJR 181:321–329
36. Arch ME, Frush DP (2008) Pediatric body MDCT: a 5-year follow-up survey of scanning parameters used by pediatric radiologists. AJR 191:611–617
37. Brody AS, Frush DP, Huda W et al (2007) Radiology AAP. Radiation risk to children from computed tomography. Pediatrics 120:677–682
38. Frush DP, Donnelly LF, Rosen NS (2003) Computed tomography and radiation risks: what pediatric health care providers should know. Pediatrics 112:951–957
39. Goske MJ, Applegate KE, Boylan J et al (2008) The 'Image Gently' campaign: increasing CT radiation dose awareness through a national education and awareness program. Pediatr Radiol 38:265–269