Image Gently - A Community Caring for its Youngest Patients

Donald P. Frush, MD
Pediatric Radiology
Duke Medical Center
Durham, NC
Disclosure

Research support, PI: GE Healthcare
To the point....
5 top techniques for Pediatric CT
(after making sure CT is the right test)

- Adjust kVp for size
- Adjust mA(s) for size
- Minimize multiphase scanning
- Minimize overlap
- Limit coverage
...and avoid “bad” techniques

- Poor sedation
- Large overlap
- Not using IV contrast media
- Not understanding mA modulation
## Dose (range) for kids

**ED; usually by DLP method***(in preparation)***

<table>
<thead>
<tr>
<th>Region of body</th>
<th>Effective dose per DLP (mSv (mGy cm)^{-1}) by age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0^{a}</td>
</tr>
<tr>
<td>Head &amp; neck</td>
<td>0.013</td>
</tr>
<tr>
<td>Head</td>
<td>0.011</td>
</tr>
<tr>
<td>Neck</td>
<td>0.017</td>
</tr>
<tr>
<td>Chest</td>
<td>0.039</td>
</tr>
<tr>
<td>Abdomen &amp; pelvis</td>
<td>0.049</td>
</tr>
<tr>
<td>Trunk</td>
<td>0.044</td>
</tr>
</tbody>
</table>

^{a}All data normalised to CTDI\textsubscript{w} in the standard head CT dosimetry phantom.

^{b}Data for the head & neck regions normalised to CTDI\textsubscript{w} in the standard head CT dosimetry phantom; data for other regions normalised to CTDI\textsubscript{w} in the standard body CT dosimetry phantom.

*Shrimpton et al. Br J Radiol 2006; 79:968*
Know which CTDI phantom is used!

<table>
<thead>
<tr>
<th>Series</th>
<th>Type</th>
<th>Scan Range (mm)</th>
<th>CTDIvol (mGy)</th>
<th>DLP (mGy·cm)</th>
<th>Phantom cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Scout</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Axial</td>
<td>131.000-5106.525</td>
<td>13.57</td>
<td>193.46</td>
<td>Head 16</td>
</tr>
</tbody>
</table>

Total Exam DLP: 193.46

So ….. you must use both

- correct k-coefficient, and
- correct phantom size DLP
1 yo; Abdomen Pelvis CT

\[
DLP_{16cm} \times K\text{-coefficient} = ED \text{ (mSv)}
\]

\[
122 \times 0.03 = 3.4 \text{ mSv}
\]
Dose (range) for kids
ED; usually by DLP method (in preparation)

- Head CT : 3 mSv (1-8 mSv)
- Chest CT : 3 mSv (1-10 mSv)
- Abdomen CT : 6 mSv (1-14 mSv)
- CTA : 2-8 mSv (< 1.0 - ? mSv)
- In general “doses” will be slightly higher in younger children
I consider the radiologist’s responsibility with (radiation) dose to be the same as any physician’s with (medication) dose.

Over (or under) dosing is a medical error.
Image Gently
Promoting CHANGE through Communication Campaign

• Increase knowledge
• Alter societal attitudes, and
• Achieve change
• Define Image Gently
• Measuring success
• Identifying contributing factors
The problem

CT scans in *children*

- Performed often
- Increasing
- Can be high dose...
# Pediatric 64-slice MDCT

5 yo phantom

<table>
<thead>
<tr>
<th></th>
<th>ED (mSv)</th>
<th>SD (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest w/ modulation</td>
<td>3.05</td>
<td>0.14</td>
</tr>
<tr>
<td>Chest w/o modulation</td>
<td>3.05</td>
<td>0.14</td>
</tr>
<tr>
<td>Chest Extreme</td>
<td>42.95</td>
<td>0.55</td>
</tr>
<tr>
<td>Abdomen w/ modulation</td>
<td>7.32</td>
<td>0.33</td>
</tr>
<tr>
<td>Abdomen w/o modulation</td>
<td>6.34</td>
<td>0.35</td>
</tr>
<tr>
<td>Abdomen Extreme</td>
<td>118.9</td>
<td>1.85</td>
</tr>
</tbody>
</table>
Increased Pediatric CT in the Emergency Department

CT: Patterns of Use

- 30 - 65 million examinations in U.S.
- Up to 11% of CT exams are pediatric
- 4-7 million pediatric CTs
- 17% of these in children 0-5 years old
- If 50% involve two phases ....
- 97,500,000 “dose events” per year
- 2002 US population: 281,000,000
- 1 CT for every 3.5 people
What is Image Gently?

- A Campaign by: Alliance for Radiation Safety in Pediatric Imaging of education and awareness
- ADVOCACY (not alarming)
- To improve radiation protection for children
- 53 health care organizations/agencies (4/10)
- >700,000 participants worldwide: - radiologists
  - radiology technologists
  - medical physicists
Background

- 2006 – Concept: The Society for Pediatric Radiology
- 2007 - ASRT, ACR, AAPM co-founding partners
- Fall 2007 - Alliance partnership
- August 2008 – CT vendor summit
- January 2009 – Parent brochure
- August 2009 – Pediatric interventional rollout
- February 2010 – CR/DR vendor summit
Alliance for Radiation Safety in Pediatric Imaging

- Academy of Radiology Research
- American Academy of Pediatrics
- American Board of Radiology
- American Board of Radiology Foundation
- American Institute of Ultrasound in Medicine
- American Osteopathic College of Radiology
- American Registry of Radiologic Technologists
- American Roentgen Ray Society
- American Society of Emergency Radiology
- American Society of Head and Neck Radiology
- American Society of Pediatric Neuroradiology
- Asia-Oceania Federation of Organizations for Medical Physics (new 9/16/2009)
- Asian-Pacific Society for Paediatric Radiology
- Association of Collegiate Educators in Radiologic Technology (new 8/27/2009)
- Association of University Radiologists
- Australian & New Zealand Society for Paediatric Radiology
- Canadian Association of Medical Radiation Technologists
- Canadian Association of Radiologists
- Canadian Interventional Radiology Association
- Canadian Organization of Medical Physicists
- Coalition for Imaging and Bioengineering Research
- College of Radiology, Academy of Medicine of Malaysia
- Conference of Radiation Control Program Directors
- European Society of Paediatric Radiology
- Health Physics Society (new 10/8/2009)
- Indian Society of Pediatric Radiology (new 9/25/2009)
- International Atomic Energy Agency (new 9/14/2009)
- International Radiology Quality Network (IRQN)
- International Society of Radiographers and Radiological Technologists
- International Society of Radiology (new 8/20/2009)
- National Council on Radiation Protection and Measurements
- North American Society for Cardiovascular Imaging
- Radiological Society of North America
- The Royal Australian and New Zealand College of Radiologists Society of Interventional Radiology
- Sociedad Latino Americana de Radiología Pediátrica
- Sociedad Mexicana De Radiología E Imagen
- Sociedad Española de Protección Radiológica (new 10/23/2009)
- Society for Pediatric Interventional Radiology
- Society of Computed Body Tomography and Magnetic Resonance
- Society of Gastrointestinal Radiologists
- The Society of Nuclear Medicine
- The Society of Nuclear Medicine - Technologist Section
- Society of Radiographers of Trinidad and Tobago
- Society of Radiologists in Ultrasound
- Society of Uroradiology
- Southeast Asia Federation of Organizations for Medical Physics
Message

CT helps us save Kids' lives!
But, did you also know...

When you image, radiation matters!
– Children are more sensitive to radiation
– What we do now lasts for their lifetime
So, when you image, *image gently*

- More scanning is usually not better
- When CT is the right thing to do:
  - Child size the kVp and mA
  - One scan (single phase) is usually enough
  - Scan only the indicated area
Technology Assessment Institute: Summit on CT Dose

From the Guest Editor’s Notebook

The Image Gently Campaign: Working Together to Change Practice

Acute increase in the New England Journal of Medicine [1], November 29, 2007, raised important concerns about the use of CT in children. There may be disagreement within the medical community about the necessity of the risk, but it is acknowledged that the risk of radiation was underestimated by the authors. Those arguments will be presented in the near future. However, in the interim, we are committed to elevating the potential of reducing the number of CT scans in children and improving the care provided to those children.

The message of the Image Gently campaign is simple: Reduce or "Image Gently" the amount of radiation used when obtaining a CT scan in children. This message is targeted to the radiologists who perform low- and medium-risk examinations of pediatric patients in their hospital or outpatient practice but who, in aggregate, perform many pediatric CT examinations throughout the United States. We know radiologists and radiology technologists want to do the best for their pediatric patients but may be hampered by a lack of familiarity with pediatric protocols.

The Image Gently campaign seeks to provide those radiologists and technologists who work in pediatricly "safety"-focused hospital settings with the tools to decrease radiation by doing simple things.

First, reduce or "Image Gently" the amount of radiation used. This can be accomplished simply by positioning your patient correctly and choosing CT protocols designed for pediatric patients. If the scan is above the highest suggestions, reduce your technique for adult patients. Next, access the Image Gently Website (www.imagingly.org) and view the procedures provided for children. The beauty of these protocols is that they are independent of equipment manufacturer, age of equipment, or number of detectors. Although the recommendations are safe, they may vary from scan-to-scan in a given area. Each protocol provides a starting point for making this important change in your practice. Work with radiology technologists to implement the protocols. These professionals control the critical "last step" before a scan is obtained.

Second, scan only when necessary. An increased awareness about the actual to-

One size does not fit all...

Communication skills in medicine are critically considered in the context of the doctor-patient relationship. However, it is critical that medical organizations and specialties communicate effectively with their constituencies to effect change for the public good. This is made more complicated by the use of mass media campaigns, which are increasingly used to help prevent or manage various health conditions. These campaigns use public media and consumer marketing techniques to promote behavior changes that will improve the health of the population [2].

Communication skills in medicine are typically considered in the context of the doctor-patient relationship. However, it is critical that medical organizations and specialties communicate effectively with their constituencies to effect change for the public good. This is made more complicated by the use of mass media campaigns, which are increasingly used to help prevent or manage various health conditions. These campaigns use public media and consumer marketing techniques to promote behavior changes that will improve the health of the population [2].

Communication campaigns are an accepted method for shaping societal attitudes, increasing knowledge, and achieving social and behavioral change within public health and the social sciences. The Image Gently campaign is a national education and awareness campaign in radiology designed to promote the need for action to decrease radiation to children when CT scans are indicated. In this article, the relative newness of mass media campaigns is reviewed and the theoretical basis for an effective communication campaign in radiology is discussed. Communication strategies are considered and the type of outcomes that should be accomplished are reviewed. This methodology has demonstrated that simple, straightforward safety messages on radiation protection targeted to medical professionals throughout the radiology community, utilizing multiple media, can affect awareness potentially leading to change in practice.

Key Words: Social marketing, public campaigns, mass media, radiation protection, children


Effective communication is essential to the process of high quality medicine. —Kasten W [4]

Communication campaigns are an accepted method for shaping societal attitudes, increasing knowledge, and achieving social and behavioral change within public health and the social sciences. The Image Gently campaign is a national education and awareness campaign in radiology designed to promote the need for action to decrease radiation to children when CT scans are indicated. In this article, the relative newness of mass media campaigns is reviewed and the theoretical basis for an effective communication campaign in radiology is discussed. Communication strategies are considered and the type of outcomes that should be accomplished are reviewed. This methodology has demonstrated that simple, straightforward safety messages on radiation protection targeted to medical professionals throughout the radiology community, utilizing multiple media, can affect awareness potentially leading to change in practice.

Key Words: Social marketing, public campaigns, mass media, radiation protection, children


Fig. 1.—Example of a shoot to the patient in an advertisement for the Image Gently campaign. Patient with full body imaging. The pediatric radiologist ensures that the CT images are obtained in the patient's best interest and in the best interest of the child.
## Role of the Qualified Physicist

*Keith Strauss, Medical Physicist, Boston Children’s Hospital*

### Abdomen

<table>
<thead>
<tr>
<th>PA Thickness (cm)</th>
<th>Approx Age</th>
<th>mAs Reduction Factor (RF)</th>
<th>Estimated mAs = BL x RF (fill in)</th>
<th>mAs Reduction Factor (RF)</th>
<th>Estimated mAs = BL x RF (fill in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>newborn</td>
<td>0.31</td>
<td>31</td>
<td>0.29</td>
<td>29</td>
</tr>
<tr>
<td>12</td>
<td>1 yr</td>
<td>0.36</td>
<td>36</td>
<td>0.34</td>
<td>34</td>
</tr>
<tr>
<td>14</td>
<td>5 yr</td>
<td>0.61</td>
<td>61</td>
<td>0.57</td>
<td>57</td>
</tr>
<tr>
<td>16</td>
<td>10 yr</td>
<td>0.71</td>
<td>71</td>
<td>0.63</td>
<td>63</td>
</tr>
<tr>
<td>19</td>
<td>15 yr</td>
<td>0.77</td>
<td>77</td>
<td>0.69</td>
<td>69</td>
</tr>
<tr>
<td>22</td>
<td>small adult</td>
<td>0.91</td>
<td>91</td>
<td>0.84</td>
<td>84</td>
</tr>
<tr>
<td>25</td>
<td>med adult</td>
<td>Baseline (BL)</td>
<td>100</td>
<td>0.93</td>
<td>93</td>
</tr>
<tr>
<td>31</td>
<td>large adult</td>
<td>1.33</td>
<td>133</td>
<td>1.21</td>
<td>121</td>
</tr>
</tbody>
</table>

### Head

<table>
<thead>
<tr>
<th>PA Thickness (cm)</th>
<th>Approx Age</th>
<th>mAs Reduction Factor (RF)</th>
<th>Estimated mAs = BL x RF (fill in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>newborn</td>
<td>0.47</td>
<td>94</td>
</tr>
<tr>
<td>16</td>
<td>2 yr</td>
<td>0.83</td>
<td>166</td>
</tr>
<tr>
<td>17</td>
<td>6 yr</td>
<td>0.93</td>
<td>186</td>
</tr>
<tr>
<td>19</td>
<td>med adult</td>
<td>Baseline (BL)</td>
<td>200</td>
</tr>
</tbody>
</table>
• Define Image Gently
• Measuring success
• Identifying contributing factors
The Alliance for Radiation Safety in Pediatric Imaging

Website has been visited 99,234 times

The protocol has been downloaded over 9,439 times

2058 medical professionals have taken the pledge
Image Gently:
Activities and Accomplishments

- Parent Information
Image Gently: Activities and Accomplishments

- Parent Information
- Translations

9 languages: Arabic, Chinese (traditional and Mandarin), German, Korean, Portuguese, Spanish, Thai, Turkish

Planned: Dutch, French, Hindi, Japanese, Tagalog, Urdu, Polish
Yes, I want to image gently.

Recognizing that every member of the healthcare team plays a vital role in caring for the patient and wants to provide the best care, I pledge:

- to make the image gently message a priority in staff communications this year
- to review the protocol recommendations and, where necessary, implement adjustments to our processes
- to respect and listen to suggestions from every member of the imaging team on ways to ensure changes are made
- to communicate openly with parents

Thank you for committing to the goal to image gently when you image or treat children.

Spread the word in your department, practice, hospital or clinic.

- First Name *
- Last Name *
Image Gently: Activities and Accomplishments

- Parent Information
- Translations
- IR Campaign (August 2009)
Image Gently:
Activities and Accomplishments

- Parent Information
- Translations
- IR Campaign (August 2
- PQI Project
Image Gently:
Activities and Accomplishments

- Parent Information
- Translations
- IR Campaign (August 2009)
- PQI Project
- NQF: revisions for 2010 “Safe Practices”
Image Gently: Activities and Accomplishments

- Parent Information
- Translations
- IR Campaign (August 2009)
- PQI Project
- NQF: revisions for 2010

Meetings:
- WHO: Children and Environmental Health June 2009
Image Gently: Activities and Accomplishments

- Parent Information
- Translations
- IR Campaign (August 2009)
- PQI Project
- NQF: revisions for 2010 “Safe Practices”
- Meetings:
  - WHO: Children and Environmental Health June 2009
  - Vendor Summit August 2008
  - CR/DR Summit February 2010 St. Louis
Image Gently Vendor Summit

August 20, 2008

Education Modules

• Four modules with content developed by the Alliance

• Vendor specific modules developed by each of the four major CT vendors
  – GE Healthcare, Siemens Healthcare, Philips Healthcare, Toshiba Medical Systems
September 2008

Re: Computed Tomography

Dear Doctor:

During the past several years, the medical and medical physics communities have raised concerns about the widespread use of multi-slice computed tomography (CT) and the resulting increases in radiation exposure to patients. These concerns have most recently led to the “Image Gently Campaign: Working Together to Change Practice” sponsored by the Alliance for Radiation Safety in Pediatric Imaging (www.imagengently.org). While CT imaging is acknowledged as an essential tool for diagnosis, the overall radiation dose to the population, especially children, has grown dramatically with the introduction of multi-slice scanners.

The purpose of this letter is fourfold: to raise awareness of the radiation burden to patients; to encourage the use of appropriate dosimetry criteria when choosing the imaging modality to be performed; to urge conscientious quality control and the lowest radiation dose commensurate with good imaging; and, finally, to encourage facilities to seek American College of Radiology accreditation for their CT programs.

At a recent meeting of the National Council on Radiation Protection and Measurements (NCRP), one of the main topics of discussion was the use of CT. During the past two decades, medical exposures to ionizing radiation have increased in number and in dose, significantly raising the radiation burden to the population exposed. According to the NCRP, the largest increase comes from the use of CT scans which is increasing 10 to 15% each year. There were approximately 3 million scans performed in the United States in 1980. By 2005, the annual number of scans had grown 20 fold, to 60 million. This type of growth has both potential benefits and risks. Specifically, the potential for making a diagnosis must be weighed carefully against the risks of carcinogenesis in the future.

When CT was first introduced, the examination was almost always requested in the form of a consultation with the radiologist. Today, the ordering practitioner has carte blanche access to all types of medical imaging procedures. This lack of consultation eliminated the step whereby the radiologist acted as gatekeeper, thus preventing an honest discussion of the benefits versus the risks that are imparted by a specific imaging procedure or the availability of alternative imaging options. To provide guidance in ordering studies, the American College of Radiology (ACR) established appropriateness criteria describing when a specific type of imaging procedure should be performed. We encourage each and every physician to review the ACR Appropriateness Criteria and whenever possible, to hold a consultation with the radiologist and discuss alternative imaging procedures.

Facilities have a number of options available when choosing and setting up their CT equipment that impact the dose given to the patient. In January of this year, the American Association of Physicists in Medicine (www.aapm.org) published Report No. 96, “The Measurement, Reporting and Management of Radiation Dose in CT.” In addition to an overview of the technology and dose determinants, this report provides methods for dose reduction. Of special interest are the technique charts based on age or size of the patient and a review of automatic exposure control systems. Facilities should use this document, along with other reports, to maximize image quality using the lowest feasible doses.

We also encourage all facilities to become accredited under the ACR Computed Tomography accreditation program. Information concerning the ACR Appropriateness Criteria as well as the accreditation program can be found at www.acr.org. The accreditation process assures that facilities periodically focus on the specific technology and “keep up” with the community standard. The ACR program includes dose guidelines that the New York State Department of Health’s Bureau of Environmental Radiation Protection (NYSDOH BER) adopted for the NYSDOH’s CT Quality Assurance program, effective January 1, 2008. The guidelines developed by the NYSDOH BER are available at www.health.state.ny.us.

Thank you in advance for your cooperation and attention to this important public health concern. If you have any questions concerning this matter, please contact Thomas W. Miller or John H. O’Connell at 518-402-7380, or by email at health.state.ny.us.

Sincerely,

Richard F. Dunn, M.D.
Commissioner of Health

* The founding organizations of the Alliance for Radiation Safety in Pediatric Imaging include the Society for Pediatric Radiology, the American College of Radiology, the American Society of Radiologic Technologists and the American Association of Physicians in Medicine. For a complete list of affiliated organizations and more information on the initiative, please go to www.imagengently.org.
September 2008

Re: Computed Tomography

Dear Doctor:

During the past several years, the medical and medical physics communities have raised concerns about the widespread use of multi-slice computed tomography (CT) and the resulting increases in radiation exposure to patients. These concerns have most recently led to the “Image Gently Campaign: Working Together to Change Practice” sponsored by the Alliance for Radiation Safety in Pediatric Imaging (www.imagegently.org). While CT imaging is acknowledged as an essential tool for diagnosis, the overall radiation dose to the population, especially children, has grown dramatically with the introduction of multi-slice scanners.
SPR Survey 2001 vs 2006: kVp

**chest**

**abdomen**

**Fig. 2**—Peak kilovoltage routinely used for pediatric chest MDCT. Amount used has decreased from 2001 [8] to 2006, with 100% of those indicating a value in 2006 survey selecting 120 kVp or less ($p < 0.001$).

**Fig. 3**—Peak kilovoltage routinely used for pediatric abdominal MDCT. Amount used has decreased from 2001 [8] to 2006, with 100% of those indicating a value in 2006 survey selecting 120 kVp or less ($p < 0.001$).
SPR Survey 2001 vs 2006: mA

Fig. 8—Mean tube current used by members of Society for Pediatric Radiology for pediatric chest MDCT over several age ranges compared with 2001 [8]. Mean tube current used decreased between 32 and 61 mA for each age range.

Fig. 9—Mean tube current used by members of Society for Pediatric Radiology for pediatric abdominal MDCT over several age ranges compared with 2001 [8]. Mean tube current decreased between 31 and 55 for each age range.
• Define Image Gently
• Measuring success
• Identifying contributing factors
Some Challenges

- Volunteer recruitment/retention
- Funding
- Maintaining Campaign success:
  - independence/integrity
  - containment
- Language translations
Image Gently template for success...

- Organization is critical
  - reputable
  - stakeholder consensus
  - independent

- Message is critical
  - important
  - simple
  - positive

- Delivery is critical
  - media experts
  - electronic media
  - control content
  - control access
  - control timing: roll outs

February 2009 rollout: increase in
- site access: 285%
- protocol downloads: 390%
- pledges: 135%
Success must be emblematic
Technology Assessment Institute: Summit on CT Dose

The Alliance for Radiation Safety in Pediatric Imaging
Thanks