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Featured Speaker

Donald P. Frush, MD, FACR FAAP
Professor of Radiology
Duke University Medical Center
By the end of this program, viewers will be able to:

- Describe pediatric radiation dose resulting from CT relative to other radiation exposures
- Identify dose management strategies for CT
- Recognize strategies for discussing salient information on potential radiation risks from medical imaging with patients and families

**Effect of X-rays on Hair: Then**

*New York Times, August 2010*

- 100 mSv dose - general threshold for cancer risk

**Effect of X-rays on Hair: Now**

*New York Times, August 2010*

**Typical Medical Radiation Doses (mSv)**

<table>
<thead>
<tr>
<th>Type of test in 5 year-old</th>
<th>Radiation dose</th>
<th>CXR equiv.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-view ankle</td>
<td>.0015</td>
<td>1/14th</td>
</tr>
<tr>
<td>2-view chest</td>
<td>.02</td>
<td>1</td>
</tr>
<tr>
<td>TC-99m radionuclide gastric emptying</td>
<td>.06</td>
<td>3</td>
</tr>
<tr>
<td>TC-99m radionuclide cystogram</td>
<td>.18</td>
<td>9</td>
</tr>
<tr>
<td>TC-99m radionuclide bone scan</td>
<td>6.2</td>
<td>310</td>
</tr>
<tr>
<td>FDG PET CT</td>
<td>10-15</td>
<td>750</td>
</tr>
<tr>
<td>Fluoroscopic cystogram</td>
<td>&lt;.33</td>
<td>16</td>
</tr>
<tr>
<td>Chest CT</td>
<td>Up to 3</td>
<td>150</td>
</tr>
<tr>
<td>Abdomen CT</td>
<td>Up to 5</td>
<td>250</td>
</tr>
</tbody>
</table>

**Low-level Radiation Risks**

- 100 mSv dose - general threshold for cancer risk

**Multidetector CT in the U.S.**

- 82,000,000 examinations per year
- If 50% involve two phases, there are 120,000,000 “dose events” per year
- Factoring 1 CT for every 2.6 people per year, with US population in 2010 at 310 million

  Conservative Estimate = 1 CT for every 9.6 people
**All Exposure Categories**

- **Radon & Other Background**: 37%
  - CT: 24%
  - Nuclear Medicine: 12%
  - Interv. Fluoroscopy: 7%
  - Conv Rad/Fluoro: 5%
  - Space: 5%
  - Internal: 5%
  - Consumer: 2%
  - Occupational: <0.1%
  - Industrial: <0.1%

**Why So Much? It’s Complicated**

- The medical/scientific imaging community
- Manufacturers/industry
- Non-radiologists
- Healthcare payers
- Government
- Health policy makers
- Administration
- Lawyers
- Public
- Patient
- Parents/caretakers
- Media

**CT Benefits: Dx of Appendicitis**

- **Among 2005 JAMA review of many medical specialists:**
  - 93% practiced defensive medicine
  - 43% used imaging technology in clinically "unnecessary" situations

**Financial Interest & Utilization**

- Bhargavan et al., June 2011
- Mean images/episode by physicians with financial interest in modality to mean for physicians without
  - CT: 2.56
  - MRI: 1.40
  - Nuclear medicine: 1.38
  - Ultrasound: 1.41
  - Radiography: 1.11
  - All modalities: 1.72

**Defensive Medicine & Malpractice**

- Among 2005 JAMA review of many medical specialists:
  - 93% practiced defensive medicine
  - 43% used imaging technology in clinically “unnecessary” situations

**We Do A Lot in Kids**

- 161,864 (6%) DIR studies in children:
  - 8% head
  - 5% AP
  - 2% chest
- 11-18 year olds received:
  - 56% of brain scans
  - 72% of AP
  - 63% of chest
Dose Estimates

- Doses Vary - a Wide Range of Estimates
- CT dose can be relatively high
- Scanning is not infrequent in kids
- Similar scans or doses can vary substantially

Implications

- CT dose can be relatively high
- Scanning is not infrequent in kids
- Similar scans or doses can vary substantially

Public Perceptions

- “...about 1500 of those [children] will die later in life from radiation induced cancer...”
- USA Today 2001

“...We Are Giving Ourselves Cancer”
- Illustration: Ben Jones
- January 30, 2014

Communicating Risk

- Medical Literature Can Be Confusing
  - Low level radiation (e.g., CT) is beneficial
  - Low level radiation is killing us
  - Risk of low level radiation is uncertain

Communicating Risk

- New data shows risk in children greater for 30% of cancers, equal to adults in 25%, and less than adults in 10%. The rest - 35% - is unknown
- Estimated: atomic bomb data, medical exposure, occupational exposure, environmental exposure
- Debated: may be zero, or may be 1 in 500-10,000 risk from low dose

Why The Debate?
What’s Not Debatable

- Longer lifetime to manifest radiation-induced injury (cancer, cataracts)
- Each exam (dose) considered cumulative
- Same settings: higher dose for children’s tissues (in general) are more vulnerable

Pediatric CT Dose Management

- Other modalities? Always consider ultrasound
- Patient preparation
- Adjust parameters
  - Size
  - Region
  - Indication
  - Don’t ignore impact of IV contrast media
- Avoid/modify multiphase exams (< 5%)
- Limit coverage

Content is Important

What is Image Gently?

- Advocacy Goal:
  - To improve medical radiation protection for children

Members and Organizations

- Over 90 health care organizations/agencies (30+ international)
- Over 1,000,000 participants worldwide: radiologists, technologists, medical physicists, other providers

- Communication campaign
- Social marketing strategy
- Education and awareness

For imaging experts, patients, families, caregivers, referring healthcare providers

Raising Awareness

- Communication Through Social Marketing Strategy
  - Website
  - Campaigns
  - Speakers group
  - Scientific publications
  - Summits
  - Speakers at national meetings
- Parent/provider brochures (with translations)
- Newsletter
- Facebook & Twitter
Uncertainty is challenging to discuss
- Patient/caregiver perspectives are complex
- Low probability of “bad” generally overemphasized
- Many ways to frame relative risks: other radiation, other life events, days lost
- Keep it simple and direct, but anticipate divergence

Risk Communication

Medical (Imaging) Environment
- Potential lack of control (helplessness)
- Unfamiliarity
- Decisions for others
- High anxiety
- Sense of urgency
- Potential consequences
- Limited access

Risk Communication

What do parents hear?
When you say “1 in 2,000 risk of cancer” ...
they hear “my child is at risk”

Communicating with Parents

Clinician Response
- That is a good question
- We know the doses
- We can minimize radiation
- This is a necessary/important exam (avoid “numbers”)

Communicating with Parents

Will You Discourage the Examination?
No, Its OK to Tell Parents
Tenets To Remember

- Imaging (CT) is beneficial
- Patients have rights (autonomy)
- Physicians have responsibility to inform
- Content is important
- Delivery is equally important: who, when, how

Resources

WHO Communication Tool for Health Care Providers (In Preparation)

Resources

- CT is useful
- CT is used frequently
- Radiation exposure is necessary
- Single CT risk uncertain, at most small
- A mindful, reassuring dialogue is important

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Conclusions

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