Radiation Risk Communication to Patients and Parents: 
Translating science into practice- 
What to say, what to do

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Faculty Disclosure Information
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In the past 12 months, I have no relevant financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.
I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation.
Effective communication requires

Factual content
Good style of communication

Broder JS, Frush DP. J Am Coll Radiol 2014;11:238-242

Learning objectives

After completing this learning activity, participant should be able to:

- Provide an update on radiation and dose
- Discuss the controversy and potential risks associated with ionizing radiation
- List talking points about radiation risk when speaking to parents
- Discuss Image Gently educational materials as resources for parents and medical imaging professionals

“How safe is a CT scan for my child?”
QUESTIONS

Question 1
Why is there concern about radiation used in medical imaging?

Why is radiation a “hot topic”? 

- use of imaging in early 2000’s
  - accuracy and advances in technology contribute to increased use
- emphasis on safety due to medical error
  - government/media attention
Increasing use of CT scans in the United States
Pediatric CT is increasing worldwide—Up to 7 million scans/yr


Patterns of use in children
n = 355,088 United Healthcare database
1 in 43 children get imaging

Dorfman AL et al. ARCH PEDIATR ADOLESC MED-VOL 165 (NO. 5), MAY 2011
Question 2

What is the potential harm?

FACT: Radiation in very large doses causes cancer

http://www.history.mny.org/photos/images/t/100797/d66703.jpg
Are 2-5x more sensitive to radiation for most cancers

Have a longer life to express those changes...cancer latency is 10-40 years!

We assume that a large number of CT exams increases risk

Scaife ER, Rollins MD. Seminars in Pediatric Surgery 2010;19:252

Data from the A-bomb survivors expressing the relevant risk for cancer mortality. Relevant dose range for pediatric CT: 6-100 mSv (0.006-0.1 Sv). "There is direct, statistically significant evidence for risk in the dose range from 0 to 0.1 Sv." Reproduced with permission from Springer Verlag

From pediatricradiology.ccf.org  Slovis TL. Radiation safety

**Two types of radiation effects**

High dose  tissue effects (acute)

Lower dose  stochastic effects (delayed)
Most tissue effects occur at 1 month

Increased attention to risk from medical radiation exposure

CBS13 Investigates: Radiation Overexposure
Radiation Overexposure Involving A 2-Year-Old Child

ARCATA (CBS13) — Inside the Bay State of two-year-old Jacoby A., the mother really knows for sure what's going on.

"I just want him to be OK," says Carla, reporting.

Ruth, Jacoby's mother.

But Jacoby's mother Carla, and his father Pedro and Jacoby himself may very well be the rest of their lives not knowing.

Figure 1. Radiotherapy in the right arm of a 7-year-old patient. (Photograph taken 6 weeks after radiotherapy; reprinted from Reference 5 with the permission of the British Journal of Radiology.)
Tissue effects - Dose dependent with threshold ➔ predictable

New York Times July 31, 2010

Stochastic effect

- Potential for cancer
- Potential for genetic effects
  - risk of event occurring is dependent on dose
  - there is assumed to be “no threshold”

From: Slovis T, Frush DP
Medical Radiation and Children
Question 3
What are relative radiation doses for common imaging exams?

[Images of medical scans]
Some facts

- A single gray is a large dose of radiation
- Most medical doses are milliGray (mGy)
- Sieverts are a similar measure but with a weighting factor for type of radiation and tissue affected. It is used in risk estimates.
- Background radiation is 3 mSv/year

More facts

- Up to 0.1 mGy for 2 view chest radiograph
- 5.0 mGy CT abdomen for 5 year old
- 10-20.0 mGy for adult-size CT abdomen
Question 4

Can radiation be measured?
FULL DISCLOSURE ....

WE HAVE NOT BEEN ABLE TO EASILY MEASURE THE RADIATION DOSE OUR PATIENTS RECEIVE!

“The determination of ionizing radiation dose to a living human from an x-ray exam is very complex.....”

JACR 2007 May 4(5) 272

“Can’t measure dose... can only estimate dose.”

Courtesy of Priscilla Butler, MS Physicist

Can radiation be accurately and easily measured at the time of the exam?

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear Medicine</td>
<td>Digital Radiographs</td>
</tr>
<tr>
<td>Fluoroscopy * Requires Kapmeter</td>
<td>Fluoroscopy No Kapmeter</td>
</tr>
<tr>
<td>CT SSDE estimate- not on manufacturers' equipment</td>
<td></td>
</tr>
</tbody>
</table>
Question 5

Does radiation cause cancer?

RISK

What is the baseline lifetime cancer occurrence in the U.S. population?

- a. 20%
- b. 40%
- c. 60%
- d. 80%

Baseline risk of death is 20%
Baseline Cancer Incidence in U.S. = 40%

Baseline incidence of death from cancer in U.S. = 20%
1 in 2,500 risk
1 in 550
Since cancer incidence is very low, this increased risk translates into 6 extra cancers over 10 years for every 10,000 children who had a CT scan.

The finding that will probably dominate media headlines is that exposure to CT in childhood increased the incidence of cancer by 24%. However, it is important to recognize that the baseline incidence of cancer in a general pediatric population is extremely small, so that a 24% increase makes this risk just slightly less small.

Sodickson A. BMJ2013;346:f3102
Image Gently “universal protocols”

"In brief, there is reasonable, though not definitive, epidemiological evidence that organ doses in the range from 5 to 125 mSv result in a very small but statistically significant increase in cancer risk."
Are CT scans carcinogenic? This is controversial.

- Hall and Brenner
  ..resulting dose to population will lead to higher cancer rates, accounting for as many as 2% of all cancers in the U.S.
- Mezrich
  ..atomic bomb different vs. “relatively low dose CT”


Image Gently
Does medical radiation cause cancer?

We don’t know
We should act cautiously as there is a risk

Increased Pediatric CT in the Emergency Department

Was outcome for the child improved?

Slide courtesy of Donald Frush, MD
Question 6
Why do we talk to parents about radiation risk?

Core principle of medical ethics
Patient Autonomy

Account for affective component in people’s perceptions of risk
Dialogue, not instruction

Should encourage certain behaviors

Should discuss benefit/risk
Question 7

How do we talk to parents about radiation risk?

WHY IS RADIATION A DIFFICULT TOPIC TO DISCUSS?

- Can't see it
- Can't easily measure it
- Effect takes years
- 40% U.S. citizens get cancer

We need a simple, positive message to avoid bias

- Patients' understanding of risk is subject to bias.
- *Hueristics*: public views an issue as "dangerous or safe"
- We do not want parents to refuse *indicated* CT for their children out of fear
**Example of huerism**

- Birth control pill in England
- Risk for pulmonary embolism greater with pregnancy
- Yet public heard “BCP is bad for health” and renounced BCP

Lloyd AJ. Qual Health Care 10 (suppl) i14-i18, 2001

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**Education for the public/ parents**

Only 7% of patients told of benefit/ radiation risk of CT scan prior to CT scan

Lee C. Radiology 231:393-398, 2004

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**Parent survey**

Only 66% aware radiation used for CT scan- No parent refused CT

Larson DB et al. AJR 189:271, 2007
90% of parents want to be told about the risk

**Talking points**

- Keep it simple—literacy level in US is 6th grade
- Emphasize the current health concern
- Describe the potential benefit
- Describe how the test will impact care
- Risks we take in every day lives
- Opportunity to ask questions

**Phrases to use**

- “We need more information to clarify your child’s diagnosis…”
- “Comparing the potential risks of CT against the risk of your child’s condition, the safest course is…”

Broder JS, Frush DP. J Am Coll Radiol 2014;11:238-242
Discussion of radiation risk is complex—care must be taken to avoid parents refusing indicated scans

Can we discuss this some more?

OK
I have some questions!

Question 8
Should we be getting informed consent for CT scans?

Shared Decision-Making: Is It Time to Obtain Informed Consent Before Radiologic Examinations Utilizing Ionizing Radiation? Legal and Ethical Implications
Loretta G. Doms, MD

Key Words: Evaluation, radiation effects, CT, informed consent, ethics, shared decision making

Reference: Doms LG. Radiol. 2010;240(2):403–412. © 2013 Published by Elsevier Inc. on behalf of American College of Radiology
Len Berlin, MD

- “There is insufficient data to justify an unequivocal determination of whether cancer will develop from diagnostic – level radiation.”
- Current standard of care does not require informed consent
- MD have a moral duty to discuss potential risk of radiation, when appropriate

Informed decision making

"meaningful dialogue between physician and patient instead of unidirectional dutiful disclosure of alternatives, risks and benefits by a physician"
**Question 9**

What are Image Gently resources for parents?

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**IG Parent Campaign**

**Rollout January, 2009**

- 8 free parent brochures
- Free medical imaging record card

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**Image Gently Pledge**

Yes, I want to image gently. Spread the word in your department, practice, hospital or clinic.

- First Name *
- Last Name *

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**Spread the word**

Making a difference is easy when you image gently. Take the pledge today and make it a priority in staff communications this year. Help parents understand the importance of using Image Gently resources when you image or treat children.**
“How safe is a CT scan for my child?”

Radiation used in medical imaging provides great benefit for patient care. The very small potential risk of cancer should be factored in the decision as to whether or not to proceed with imaging. However, if medically justified, there should be no hesitation to obtain necessary studies.

THANK YOU