Communicating With Pediatric Patients and Their Families About Radiation Dose and Risk: A Radiologist's Perspective

Lisa J. States, MD
Professor of Clinical Radiology
Endowed Chair of Molecular Imaging
Disclosures

• No financial disclosures related to this talk.
Objectives

1 - Understand the risk-benefit analysis regarding medical imaging procedures in pediatrics
2 - Create an approach to discuss risks with parents/caregiver
3 - Develop a program using education for families and radiology team members.
Outline

1. Risks
   • a. Risks of current medical imaging procedures and protocols
   • b. Risk/Benefit analysis
   • c. Communicating with families about radiation
   • d. Awareness of risks by ordering clinicians and radiologists

2. Practice
   • a. Current practice in radiology departments
   • b. Methods of education
   • c. Discussion with parents/caregivers
   • d. Communication with children

3. Ideal program
   • a. Provide radiologists with up-to-date medical imaging practice
   • b. Define the role of physicists, technologists, nurses and child life specialists
   • c. What should an effective program look like
   • d. Discussion
Risks

• a. Risks of current medical imaging procedures and protocols
• b. Risk/Benefit analysis
• c. Communicating with families about radiation
• d. Awareness of risks by ordering clinicians and radiologists
Sedation neurodevelopment

Gadolineum based IV contrast – MRI Deposition Nephrogenic systemic sclerosis

Contrast enhanced ultrasound contrast agents

Fe containing MRI contrast agents

Iodinated IV contrast (CT) Renal toxicity Anaphylaxis Transient hypothyroidism

Ionizing radiation Computed tomography radiography nuclear medicine interventional radiology
Risks of current medical imaging procedures and protocols

• The main stochastic risk in children is potential cancer development.
• Children are at greater risk than adults
  • More sensitive due to growth and dividing cells
  • Longer life expectancy
• Computed tomography (CT) is the largest contributor.
• Short latency tumors such as brain tumors and leukemia have been reported to be associated with head CT and abdominal CT.

Risks of current medical imaging procedures and protocols

• Understand the risks of the procedures
• Know the up-to-date onsite protocols
• Many national and international organizations responsible for evaluating radiation risk agree that to be safe, we should act as if low doses of radiation cause harm.

• Practice the ALARA principle “as low as reasonably achievable”
Risk/benefit analysis

*separate risk from benefit*

Start with benefit

- Show understanding of the patient’s “unique” medical history
- Highlight the medical need (*Justification*)
- Review the alternatives and options
  - Can ultrasound or MRI answer the question?
Risk/benefit analysis

Risk

• Know the current understanding of risk
• Be able to discuss national and institutional efforts to minimize administered radiation dose
• Be able to provide resources for parents

Figure 2 Adapted from ICRP Publication 60 (1990)
Discussing Risk

- Create analogies to risk in daily life
  Risk of 1 CXR is analogous to cycling 10 miles, diving 300 miles, smoking 1.4 cigarettes.

Emphasize the additional minimal change in the natural risk of developing cancer.

*(Shane Foley, MD)*

Provided by Erfan Akbari
Communicating with families - Be prepared

- Know what you are getting into
- Gather information from others prior to discussion (Technologist, nursing, advanced practice providers, physician)
- Schedule the meeting if possible

Beware

Overprepared – has done “background research”

Feels ignored by medical establishment

mis-informed

Feels that medical care has been “wrong or induced harm”
Communicating with families

- Clearly identify your role.
- Confirm reason for discussion.
- Ask - Are you in the medical field (assess level of understanding of terminology)

Frame question
- What is your biggest concern?
- Why are we here today?
- What information would you like to discuss?

- Listen
- Empathize
- Use simple language
- Focus on a few points
- Ask questions
- Build trust
- Summarize
- Paraphrase and repeat
How should parents be informed?

• Use simple, plain language
• Stay away from statistics
• Use comparisons that put radiation exposure in perspective.
• Refer families to websites such as https://imagegently.org and https://radiologyinfo.org
Awareness of risks by ordering clinicians and radiologists

• Lack of awareness of risk on the part of referring physicians
• Clinicians may underestimate the CT-related radiation dose and associated risk of cancer.
• “community standards” do not discuss radiation as a potential risk
• lack of consensus among medical and scientific experts about the actual radiation risk from low-level radiation

Practice

• a. Current practice in radiology departments
• b. Methods of education
• c. Discussion with parents/caregivers
• d. Communication with children
Current practice

• Adult practices may be using adult settings

High percentage of pediatric ER visits are at adult hospitals

• Pediatric practices typically have equipment and protocols optimized for children
Education

- ACR appropriate use criteria
- Practice guidelines

<table>
<thead>
<tr>
<th>Relative Radiation Level</th>
<th>Effective dose range</th>
<th>Pediatric Effective Dose Estimate Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>☢️</td>
<td>Less than 0.1 mSv</td>
<td>Less than 0.03 mSv</td>
</tr>
<tr>
<td>☢️☢️</td>
<td>0.1 – 1.0 mSv</td>
<td>0.03 – 0.3 mSv</td>
</tr>
<tr>
<td>☢️☢️☢️</td>
<td>1.0 – 10 mSv</td>
<td>0.3 – 3.0 mSv</td>
</tr>
<tr>
<td>☢️☢️☢️☢️</td>
<td>10 – 30 mSv</td>
<td>3.0 – 10 mSv</td>
</tr>
<tr>
<td>☢️☢️☢️☢️☢️</td>
<td>30 – 100 mSv</td>
<td>10 – 30 mSv</td>
</tr>
</tbody>
</table>

* Adapted from ACR Appropriateness Criteria®, Radiation Dose Assessment Introduction 2016
Discussion with parents/caregivers

• Risks discussed by a trusted source such as a pediatrician or radiologist are better tolerated than those discovered from an unknown source, such as the Internet.

• By providing information up front, parent–patient autonomy is respected.

• When parents assume a risk voluntarily, their acceptance is improved compared with when the risk has been imposed unknowingly on their child.

Larson DB, Rader SB, Forman HP, Fenton LZ. Informing parents about CT radiation exposure in children: it’s OK to tell them. AJR 2007; 189:271–275
Benefit of informational handout

- **Study by Larsen D, Rader S, Forman P and Fenton L.**
- **OBJECTIVE.** The purpose of our study was to determine how parents' understanding of and willingness to allow their children to undergo CT change after receiving information regarding radiation dose and risk.
- **MATERIALS AND METHODS.** 100 parents of children undergoing nonemergent CT studies at a tertiary-care children's hospital were surveyed before and after reading an informational handout describing radiation risk. Parental knowledge of whether CT uses radiation or increases lifetime risk of cancer was assessed, as was willingness to permit their child to undergo both a CT examination that their child's doctor recommended and one for which their doctor thought observation might be equally effective.
- **RESULTS.** Of the 100 parents who were surveyed, 66% believed CT uses radiation before reading the handout, versus 99% afterward ($p < 0.01$). Before reading the handout, 13% believed CT increases the lifetime risk of cancer, versus 86% afterward ($p < 0.01$). After reading the handout, parents became less willing to have their child undergo CT given a hypothetic situation in which their doctor believed that either CT or observation would be equally effective ($p < 0.01$), but their willingness to have their child undergo CT recommended by their doctor did not significantly change.
  - After reading the handout, 62% of parents reported no change in level of concern.
  - **No parent refused or requested to defer CT after reading the handout.**
- **CONCLUSION.** A brief informational handout can improve parental understanding of the potential increased risk of cancer related to pediatric CT without causing parents to refuse studies recommended by the referring physician.
Radiologist-child interaction

• Explore level of interest or knowledge
• Beware of anxiety produced by parents
• Include parents in discussion
Childlife specialist

• Focused on child
• Address issues of anxiety
• Use age-appropriate tools to decrease anxiety (books, videos)
• Refer to physician if specific radiation questions are asked
Technologist

• Expected to provide information to allay fears of families.
  • Discuss collimation
  • Discuss reason for parent wearing lead and child not wearing it
• Provide information regarding practice against shield use.
  collimate, no repeats, do not obscure useful information
Ideal program

• a. Provide radiologists with up-to-date medical imaging practice
• b. Define the role of physicists, technologists, nurses and child life specialists
• c. What should an effective program look like
Ideal program:

• Voluntarily providing information at or near the time of performance of the CT examination is optimal and should be the goal rather than waiting for patient to request information.
• Format can be pamphlet, websites, videos.
• Nursing staff or technologists typically confirm appointments. This would be an ideal time to guide the family to the information or ask if they have questions.

• In a survey conducted by Lee et al, only 15% of academic radiology departments provide radiation risk information before CT.
Provide up-to-date medical education

- Discuss new technology – CT, fluoroscopy, radiography, interventional radiology, nuclear medicine
- Changes in practice – such as *not using* lead shielding
- Dose reduction practices – nuclear medicine administered dose
- Encourage on-site involvement in focused initiatives of national organizations
- Share with entire team in monthly conference- technologists, radiologists, nursing staff and advance practice providers
- Develop dose reduction processes with on-site physicist
What parents want from physicists

<table>
<thead>
<tr>
<th>Study</th>
<th>Date of Study</th>
<th>Estimated Effective Dose (mSv)</th>
<th>Equivalent of Days Background Radiation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET PETCT, WB DOTATATE (CT)</td>
<td>12/27/2019</td>
<td>0.50</td>
<td>61</td>
</tr>
<tr>
<td>Ga68-DOTATATE, 3.5 mCi (PET)</td>
<td>12/27/2019</td>
<td>3.37</td>
<td>410</td>
</tr>
<tr>
<td>FLUORO &lt; 1 HOUR (PICC)</td>
<td>12/27/2019</td>
<td>0.01</td>
<td>1</td>
</tr>
<tr>
<td>PET PETCT, Hi FDOPA (Child) (CT)</td>
<td>1/7/2020</td>
<td>0.09</td>
<td>11</td>
</tr>
<tr>
<td>F-18 DOPA, 7.1 mCi (PET)</td>
<td>1/7/2020</td>
<td>8.41</td>
<td>1023</td>
</tr>
<tr>
<td>CT Abdomen ABDOMEN_ENHANCED_Customized</td>
<td>1/7/2020</td>
<td>1.40</td>
<td>170</td>
</tr>
<tr>
<td>FLUORO &lt; 1 HOUR (PICC)</td>
<td>1/13/2020</td>
<td>0.08</td>
<td>9</td>
</tr>
<tr>
<td>XR ABD 2W AP SUPINE &amp; ERECT</td>
<td>1/28/2020</td>
<td>0.80</td>
<td>97</td>
</tr>
<tr>
<td>XR ABD 1W AP SUPINE</td>
<td>2/11/2020</td>
<td>0.40</td>
<td>49</td>
</tr>
<tr>
<td>PET PETCT, WB DOTATATE (CT)</td>
<td>12/9/2020</td>
<td>0.53</td>
<td>65</td>
</tr>
<tr>
<td>Ga68-DOTATATE, 3.69mCi (PET)</td>
<td>12/9/2020</td>
<td>3.55</td>
<td>432</td>
</tr>
</tbody>
</table>

**Note**

The estimated effective doses provided are based on our typical exam protocols and your child’s age at the time of the studies. These values represent the ranges of radiation doses of the studies and were estimated based on reasonable assumptions and available pediatric dose evaluation tools. They are not intended to be interpreted as your child’s personalized radiation dose monitoring.

*The average person in the U.S. receives an effective dose of about 3.1 mSv per year, or 0.008 mSv per day.*
# Summary

**Table 13: Checklist on Dos and Don’ts When Communicating Risks**

<table>
<thead>
<tr>
<th>Category</th>
<th>Do’s</th>
<th>Don’ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truthfulness</td>
<td>Tell the truth</td>
<td>Do not lie or avoid the truth</td>
</tr>
<tr>
<td>Absolutes</td>
<td>Avoid absolutes -- nothing is absolute</td>
<td>Do not use the terms ‘never’ or ‘always’</td>
</tr>
<tr>
<td>Jargon</td>
<td>Define all terms and acronyms</td>
<td>Do not use standard medical terminology</td>
</tr>
<tr>
<td>Negative</td>
<td>Use positive or neutral terms</td>
<td>Do not use negative terms or negative associations</td>
</tr>
<tr>
<td>Temper</td>
<td>Remain calm</td>
<td>Do not let your feelings interfere with your ability to communicate</td>
</tr>
<tr>
<td>Clarity</td>
<td>Ask whether you are being understood</td>
<td>Do not assume understanding</td>
</tr>
<tr>
<td>Abstraction</td>
<td>Use examples, metaphors, and analogies to aid understanding</td>
<td>Do not talk of theoretical concepts without using clear, non-technical justification</td>
</tr>
<tr>
<td>Attack</td>
<td>Only attack the issue</td>
<td>Do not attack the person or organization that may have made incorrect statements</td>
</tr>
<tr>
<td>Promise</td>
<td>Promise only what you are certain will occur</td>
<td>Do not make promises that you cannot back up and follow through on to ensure they occur</td>
</tr>
<tr>
<td>Speculation</td>
<td>Provide information only on what is being done and what you know</td>
<td>Do not discuss worst-case scenarios and unintended possible outcomes, unless required by protocol</td>
</tr>
<tr>
<td>Risk/Benefit comparison</td>
<td>Make risk and benefit statements separately</td>
<td>Do not discuss the risk relative to the benefit</td>
</tr>
<tr>
<td>Risk comparisons</td>
<td>Use tested comparison messages, cite trustworthy data/groups</td>
<td>Do not compare unrelated risks</td>
</tr>
</tbody>
</table>

*adapted from EPA Workbook on Risk Communication in Action (2007)*
Resources

• AAPM
• ACR/RSNA/
• ICRP/NCRP/BEIR VV Phase 2
• CRCPD/NEXT
• Image Gently, Image Wisely

Thank you!!