

Speaking to pediatric patients and their families about radiation dose and risk from nuclear medicine and radionuclide therapy

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Where the world comes for answers



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My Disclosures

- Nuclear medicine physicist for 40 years
- Boston Children's Hospital for 19 years
- Image Gently Steering Committee
- Conway-Treves Award from the Pediatric Imaging Council of the SNMMI
- Past President of the SNMMI (2012-2013)

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Communicating with Children and Families

- You are the message!
- When speaking to children, keep it age appropriate
- Discuss both the benefits as well as the risks!
- "Do you have any question or concerns you would like me to address?"
- Challenges communicating effectively about **nuclear medicine and radiation**

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Essential aspects of nuclear medicine

- How does nuclear medicine and molecular imaging differ from other modalities?
- Why is nuclear medicine imaging important?
- How is radionuclide therapy different than nuclear medicine imaging and radiation oncology?

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What is nuclear medicine?

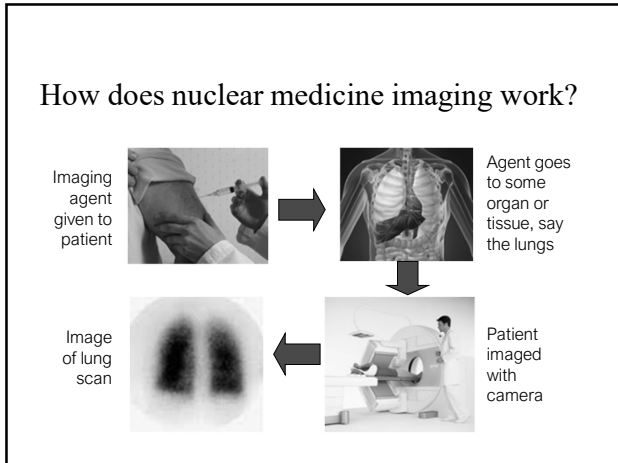
- Nuclear medicine imaging uses safe, painless, and cost-effective techniques to image physiology and function.
 - It uses very small amounts of radiopharmaceuticals and traces their progress through your body.
 - Nuclear medicine is unique, because it helps doctors "view" how your body is functioning.
 - This is different from x-rays or CT scans, which show how your body looks rather than how it works.
- Nuclear medicine therapy uses larger but targeted amounts of radiation to treat thyroid disease and cancer.

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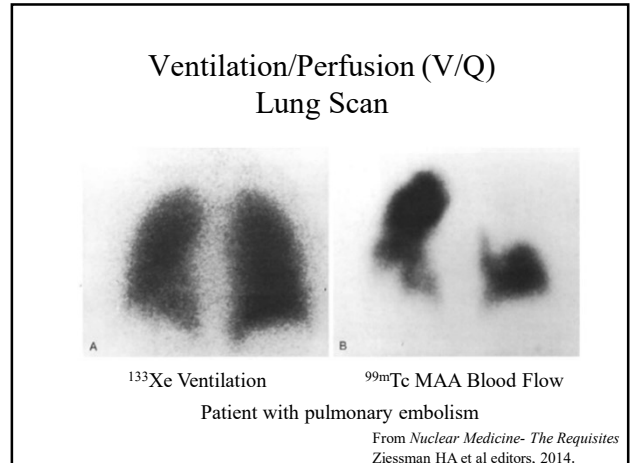
Why is nuclear medicine important?

- Enables early discovery since changes in function often occur before changes in anatomy.
- Enables quick, personalized management of treatment.
- Can safely view and treat disease and avoid more invasive procedures.
- When nuclear medicine is performed with the right test using the right dose on the right patient at the right time, it is of great clinical benefit!

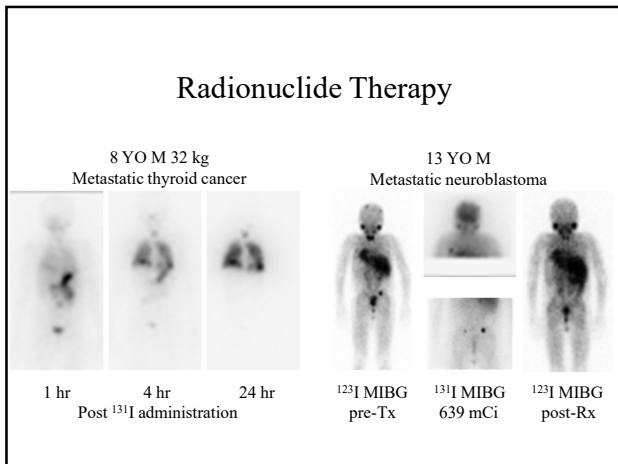
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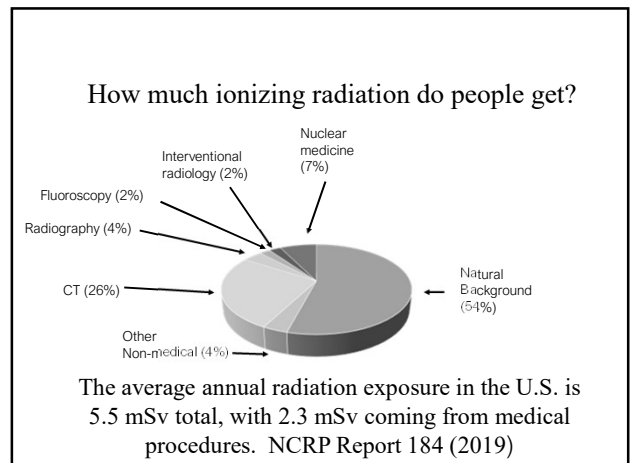
- ### Essential aspects of radiation and risk
- What is radiation?
 - Are we exposed to radiation in every-day life?
 - How is radiation measured and what are the units used?
 - Does nuclear medicine emit radiation? If so, how much?
 - Are children more sensitive than adults?
 - What is the medical community doing to try to keep the radiation dose as low as possible?

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What is radiation?

- Radiation is energy given off by a source
 - Visible light, microwaves, infrared
- Higher energy radiation may fall into the category of "ionizing radiation"
 - X-rays, gamma rays, beta and alpha particles
 - These radiations may pass through tissues but in some instances they may deliver energy to the tissues causing specific changes in atoms and molecules
 - Too much ionizing radiation may damage or even kill tissues

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Are some populations more sensitive to ionizing radiation than others?



Children
(newborn to 20 years)



Young women



Fetus

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Communication of Risk

- Need to be prepared to speak to referring physicians, patients, and parents
- In general, referring physicians have very little understanding of radiation risk and may perceive nuclear medicine as a “high dose” procedure.
- Teenage patients and parents may have seen discussions of medical radiation in the news.
- Reports have shown that informing patients regarding radiation risk does not adversely affect their willingness to have an appropriately ordered study.

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A reasonable approach is to discuss with patients and their families:

- We will be administering a small amount radioactivity in order to perform a study which emits radiation similar to that emitted by x-ray machines.
- This exposure may lead to a slight increase in the risk of contracting cancer sometime in their lifetime.
- The radiation dose from this procedure is in the range of many other radiological tests and is on the same order as that individuals get from natural background in 1-2 years.
- The dose to the parent is on the order of the radiation one would receive during a transcontinental flight.

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Is there a risk associated
nuclear medicine imaging?

- Many medicines and medical procedures can have side effects, particularly if one uses too much. The same may be true for nuclear medicine although there is no direct evidence of this.
- When recommended, these tests give your doctor important information well worth the very small risk.
- Used in the right way for the right patient at the right time, nuclear medicine is very safe and effective.

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What if I receive a number of scans?

- The risk for each scan is considered to be independent and not affected by the fact that the patient may have received radiation from scans previously
- Each scan has its own potential risk.
- Thus, the potential risk of receiving 3 PET/CT scans is 3 times that of receiving one scan.
- The risk of the 3rd PET/CT is the same as the first one.
- The appropriateness, risk and benefit of each scan should be considered independently without regard to the radiation received from previous X-rays or scans.

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How much radiation is considered too much?

- The answer is: More than is necessary.
- Each imaging procedure takes a certain amount of radiation to perform appropriately.
- Using too much leads to unnecessary radiation dose to the patient, and using too little may not provide enough information.
- Each imaging procedure is optimized for the medical task at hand, the equipment being used, and the patient.

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What is the imaging community doing?

- Image Gently (imagegently.org):
Dose optimization in pediatric imaging
- Image Wisely (imagewisely.org)
 - How to Understand and Communicate Radiation Risk (Peck, Samei)
- SNMMI (www.snmmi.org/dose)
- AAPM
 - Public Education Committee
 - Radiation and Medical Imaging: Communicating Clear Answers to Top Questions (18 questions)

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102. What are the benefits of medical imaging?

Key Messages/Shorter Answer (Soundbite):

1. Medical imaging can determine whether an invasive procedure is necessary.
2. Medical imaging can detect anatomic, physiologic, and molecular changes that cannot be found by other medical tests.
3. Medical imaging allows more effective treatment and monitoring of treatment.

Longer Answer:

1. **Medical imaging can determine whether an invasive procedure is necessary.** ^{10, 11}
 - Medical imaging can diagnose life-threatening internal injuries that need immediate surgery.
 - Patients being assessed in the emergency department after a traumatic injury can be scanned quickly, letting surgeons know in a very short time whether and where to operate.
 - Medical imaging has been shown to reduce unnecessary surgeries for many conditions, including appendicitis.
2. **Medical imaging can detect anatomic, physiologic, and molecular changes that cannot be found by other medical tests.** ^{10, 11}
 - Medical imaging can be used to detect conditions that cannot be found through blood or urine tests, measuring brain waves or cardiac rhythms, or physical examination.
 - Medical imaging can quickly diagnose life-threatening conditions, including tumors, aneurysms, congenital disorders, blocked blood vessels, internal bleeding, blood clots, spinal injuries, and bone fractures.
3. **Medical imaging allows more effective treatment and monitoring of treatment.**
 - Guiding treatment of common conditions
 - Determining if surgery is necessary.
 - Placing catheters and stents.
 - Locating, destroying, or removing tumors.
 - Reducing the length of hospitalization.

Radiation and Medical Imaging: Communicating Clear Answers to Top Questions (2022)

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Questions?



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