Radiation in medical imaging: What you need to know

We protect our children from any number of dangers: strangers, cars in the road, household chemicals; the list goes on. Recent news reports have highlighted a new hazard: medical radiation. So what is radiation? How can we protect our kids from unnecessary amounts?

Simply put, radiation is energy. It is organized on a spectrum or scale according to frequency. We are all familiar with the lower energy types of radiation: microwaves, visible light, radio waves, infrared light, etc. These types of radiation are non-ionizing, meaning they do not possess enough energy to remove an electron from the orbit of an atom. Non-ionizing radiation can be harmful (think about leaving a piece of chicken in the microwave too long), but not in the same way as ionizing radiation.

What is ionizing radiation?
Ionizing radiation does possess enough energy to remove that electron from its atom. This type of radiation can cause damage in several different ways. A single large dose can produce short term effects and long term effects, while repeated smaller doses can only produce long term effects. Short term effects include skin burns, hair loss, damage to reproductive cells, and damage to cells of the bone marrow. This type of damage will be evident within days or weeks of the exposure. It is important to note that the dose required to produce these effects is quite high.

Long term effects from ionizing radiation are the result of a single, high dose exposure or to lower doses of radiation over a long period of time. These repeated, low dose exposures are the type we are most likely to encounter in medical imaging. Long term effects include cataracts, radiation-induced dermatitis, and cancer. To cause cataracts, the radiation exposure must be concentrated to the eyes; to cause dermatitis, the exposure must be concentrated on an area of skin.

Researchers have found a link between exposure to radiation and leukemia (blood or bone marrow cancer) in both atomic bomb survivors and early radiologists. These populations were exposed to significant radiation doses, either in a single event, or over a lifetime. Today, because cancer is a relatively common disease, we cannot prove that medical radiation alone is responsible for any given case.

When a child is brought to a doctor’s office or a hospital, the physician may use any number of

different imaging exams, or modalities, to help diagnosis an illness. Some of these use radiation, and some do not. Here's a breakdown of the different modalities.

Modalities that use ionizing radiation

X-ray: X-ray exams use ionizing radiation to produce images of the body. Generally, bone will absorb x-rays, and soft tissues (ligaments, tendons, internal organs) will allow x-rays to pass through. The difference between the tissues produce the image.

CT: CT, CAT, or computed tomography tests also use ionizing radiation. A CT uses a rotating x-ray tube to produce three dimensional images of the body. These exams provide much more detail and information, but also give a higher dose than regular x-ray exams.

Angiography: This modality uses x-rays combined with contrast, or x-ray dye, to view the heart and blood vessels throughout the body. These exams are used when a blockage of a vessel is suspected; physicians can also treat particular issues during an angiogram.

Nuclear Medicine: These tests use compounds called radionuclides to demonstrate function of a particular organ or system. The radionuclide emits radiation, which is captured by cameras. The compounds can be injected, inhaled, or ingested.

Modalities Not Using Ionizing Radiation

Ultrasound: Ultrasound uses a high frequency sound wave to produce images. A transducer emits the sound wave, which bounces off the various structures in the body to produce images. Ultrasound is excellent for imaging soft tissues.

MRI: Magnetic Resonance Imaging uses a very strong magnetic field and radio waves to perform an exam. The magnetic field aligns certain atoms in the body, and the radio waves are then used to manipulate those atoms. The resulting signal is processed by a computer to produce the images.

Legacy Health has implemented a plan to help reduce pediatric radiation exposure for children. The Image Gently campaign is committed to conscientious imaging of children in all modalities, and provides guidelines for doctors, imaging technologists, and parents.

--Jennifer Adams, RT(R), staff radiologic technologist at Legacy Meridian Park Medical Center