

Medical Radiation: Understanding Dosages

It's a dilemma physicians face daily in medicine. On one hand you have a patient presenting with abdominal pain who is demanding a CT scan. On the other hand you feel that CT may offer an excellent view of the abdomen; however, the physical examination of the patient is normal. So, is it worth the risk of exposing the patient to the radiation from a CT scan?

"CT scans are particularly worrisome because the radiation dose is much stronger than a routine X-ray," explained Dennis M. O'Donnell, MD, radiologist, Wake Radiology Consultants. "In some cases, an ultrasound or other test may give physicians the results they need. The problem comes in when a patient undergoes repeated CT scans, exposing him or her to higher levels of radiation. What we have to do to ensure continued patient safety and appropriate testing is tailor each exam so that patients are exposed to the least amount of radiation to get to the answer."

Dr. O'Donnell, who recently made a presentation to the WakeMed Raleigh Campus Medical Staff Quality Improvement Committee, advocates a reasonable approach to scanning. He said that unfortunately there are no hard and fast rules that apply. "When to use a CT scan or other imaging procedure is a judgment call that physicians have to make based on their physical findings. We should always ask, 'Is there a better test that would expose the patient to less or no radiation?' Testing should never be done just because a patient demands it or if there aren't clinical reasons for it." It is also important for physicians to include their clinical concerns/suspicions when ordering a radiology

exam, as this allows the radiologist to focus the test and limit the amount of radiation exposure.

CT is particularly beneficial in diagnosing cancer or in patients who present with multiple injuries. "In WakeMed's emergency departments, for example, it is often the modality of choice to quickly determine the extent of injuries so that patients are moved to life-saving surgery or treatment," Dr. O'Donnell explained.

Dr. O'Donnell is working to educate physicians on radiation dosage for adults and pediatric patients. His goal is to arm physicians with information that will better prepare them to answer patients' questions about radiation exposure and why a particular test, such as a CT scan, is necessary. "Patients are concerned about their exposure to radiation, and it's a legitimate concern. Radiation is like pouring sand into a bucket. It goes into the bucket, but it never comes out. The radiation effect stays with you the rest of your life. The more radiation you have over your lifetime, the more likely you are to develop complications from that radiation."

The amount of radiation dose depends on the type and location of the X-ray exam. Radiation is measured in what is called millisieverts, noted as mSv. For example, a typical chest CT scan, rated at an average of 8 mSv, is equal to anywhere from 300 chest X-rays or a lifetime of mammograms. Dr. O'Donnell said that 300 millisieverts is what most radiologists consider low dose for a total lifetime dosage; however, it can vary based on each person and their genetic background. "It also makes a



difference where you scan as certain organs – thyroid, breast and gonads - are more susceptible to radiation effect.”

In the past, each new CT scanner that was manufactured increased the radiation dosages required to produce the image. “The industry was

reacting to our call for the prettiest pictures we could get, but what we found is that the pretty pictures aren’t necessary for an accurate reading. Manufacturers have now reversed the trend and are now developing scanners that will expose patients to less radiation, while giving us clear results.”

RADIATION DOSE COMPARISON

Below is a table that compares radiation doses for several common exams

PROCEDURE	TYPICAL EFFECTIVE DOSE (MSV) ¹	NUMBER OF CHEST X-RAYS FOR EQUIVALENT EFFECTIVE DOSE ²	TIME PERIOD FOR EQUIVALENT EFFECTIVE DOSE FROM NATURAL BACKGROUND RADIATION ³
Chest X-ray (PA film)	0.02	1	2.4 days
Skull X-ray	0.07	4	8.5 days
Lumbar spine	1.3	65	158 days
IV urogram	2.5	125	304 days
Upper GI exam	3.0	150	1 year
Barium enema	7.0	350	2.3 years
CT head	2.0	100	243 days
CT abdomen	10.0	500	3.3 years

Source: US Food and Drug Administration - Radiation Risks

¹ Effective dose in millisieverts (mSv)

² Based on the assumption of an average “effective dose” from chest X-ray (PA film) of 0.02 mSv.

³ Based on the assumption of an average “effective dose” from natural background radiation of 3 mSv per year in the United States.