

healthsmart!

CT Scans 101: Be an Informed Consumer

Introduction

CT (computerized tomography) scans, also sometimes called CAT scans, combine X-rays and computers to produce remarkably clear images of many parts of the body. Sometimes compared to slicing a loaf of bread (but with no knife, of course!), the CT scanner can peek inside your head, neck, chest, abdomen, arms or legs in search of injury or disease.

CT scans provide much finer detail than regular X-rays, evaluating organs that can't even be seen with X-rays. And because the scanning process is so quick, CT is especially useful for patients who have been injured, such as in traffic accidents or falls. When there are complex bone injuries, such as hip fractures for example, the CT images can be combined into a lifelike three-dimensional view to provide the surgeon with a virtual roadmap for making repairs.

But CT's contributions aren't limited to patients who've been injured. It also is a primary tool for finding tumors nearly everywhere in the body. After it reveals the tumor, repeat CT scans are used for evaluating whether the tumor is responding to therapy. Exciting new uses are being found for CT scanning, such as checking arteries (including the ones in the heart) for blockage.

What CT scans can show

CT isn't perfect. It doesn't find every disease in every patient. But it can detect many different types of illness and injury including:

- Tumors
- Infections
- Internal bleeding in the brain or body
- Bone fractures and dislocations
- Kidney stones
- Blocked arteries and veins
- Congenital heart diseases

MRI vs. PET/CT

MRI – Instead of using X-rays to create images of the body, MRI uses magnets and radio waves.

CT vs. MRI – Sometimes, either CT or MRI would be an option for a patient's particular situation. In other cases, one examination would be preferred over the other. Searching for brain tumors, for example, is better handled with MRI, while checking for blood clots in the lung is a job for CT. Your doctor and the imaging specialist reading your scan can tailor the examination to find the best answer for you. MRI scans take longer to do, sometimes require long periods without moving, and can be a problem for very sick or young patients or those with a fear of small, tight places. CT can provide a rapid alternative if MRI scanning isn't possible.

PET/CT – PET stands for positron emission tomography. This test can show how tissues and organs in the body are working, rather than just how they look.

A tiny dose of radioactive material called a tracer is injected into an arm vein and is taken up by organs throughout the body. The tracer gives off a low dose of radiation that can be detected by a scanner surrounding the patient. Body tissues that are using a lot of energy, such as tumors, take up more of the tracer, and the scanner detects that abnormal activity. Sometimes this can be referred to as a “hot spot.”

Images from a CT scan performed at the same time then are combined with the PET scan to form a 3-D view that shows exactly where in the body the abnormality is.

How is a PET/CT different from a CT or MRI scan?

CT and MRI scans are great for showing normal and abnormal anatomy but can't always tell whether something is benign or malignant – just an old scar or a living tumor, for example. Often, PET/CT can help to answer that question. In patients being treated for a known cancer, PET/CT can be a great way to see if the therapy is working and to search for any spread of the tumor.

Radiation exposure: Risky or not?

Radiation exposure should be a concern for everyone, and it certainly is for us at UK HealthCare. We want our patients to receive the lowest possible radiation dose in all of our testing. But some questions remain: Can this radiation be harmful? Might it cause cancer years from now? How much radiation is too much?

Any radiation is too much if you really don't need the test. When your doctor prescribes an examination involving radiation, it's perfectly acceptable to express your concern about radiation, to ask what they hope to learn from the test, and to ask whether other non-radiation tests could be used instead.

While the radiation risk from a single scan is quite small, the radiation dose from multiple X-ray tests over a lifetime can be significant. Patients with chronic illnesses such as cancer or Crohn's disease are the ones most likely to have multiple scans.

But every patient should take common-sense steps to protect themselves from excess radiation:

- Keep a record of any test that involves radiation. If you're unsure whether the test uses radiation, ask the person who is performing it.
- Carry the record with you. Keep and update a wallet-size card listing the imaging tests that you've had and where and when each was done. Many patients now keep the record electronically.
- If and when your doctor advises you to have a test that uses radiation, express your concern and ask a lot of questions. In particular, ask whether a test that doesn't use radiation could provide the same information.
- Be aware of dosages. After your CT scan, ask the person who performed it what dose of radiation you received. Include that information in your radiation record.

Safety first!

UK HealthCare employs a radiation safety officer (RSO) who ensures that all activities involving radioactive materials and all tests using equipment that produce radiation are performed in accordance with approved policies and regulatory requirements. Frequent testing is done to ensure that the equipment and procedures are up to standards. The radiation safety officer is authorized to prohibit use of any equipment that does not meet safety and quality guidelines as defined by UK HealthCare policies and federal and state regulations.

“You are more likely to die being struck by a car, drowning, or by radon in your home than from cancer caused by the radiation of a CT scan.”

– Scott D. Stevens, MD,
Chief, Abdominal Imaging, *UK Radiology*

Radiation exposure comparison

Humans have always lived in a radioactive world – we are exposed to natural sources of radiation constantly. Soil, rocks, building materials, air, water and cosmic radiation emit small amounts of “background radiation” all the time. If you think of the very low dose of radiation from a standard chest X-ray as equaling 1, then background radiation would equal about 30. Just living in the United States gives you as much radiation in a year as 30 chest X-rays.

So how does CT imaging compare to background radiation? The table on the right presents the average relative radiation dose-per-person for a variety of sources – both medical and non-medical. *

Will you get the lowest possible dose?

Companies that manufacture CT equipment know that you and your doctor want the best-quality scan with the lowest radiation dose. To achieve that goal here at UK HealthCare, we use a dose-reduction system. During your CT scan, a computer in the CT scanner will analyze each body section to make sure that it gets only enough radiation to get a clear view. For example, it takes a lot less radiation to see through your lungs than to look inside your liver, and so our system adjusts the radiation dose during your scan to make sure that’s what happens. We’re especially proud of how our system can reduce radiation exposure for our pediatric patients.

Source	Relative Radiation Dose (chest X-ray dose=1)
Average background	30
Chest X-ray	1
Head CT	20
Chest CT	70
Abdomen/Pelvis CT	150
Radon gas in the home	20 per year
Coast-to-coast flight	3 to 5
Watching TV	0.15 per year
Living in a stone or brick building	0.07 per year
Smoke detector	0.0008 per year

** The doses are typical values for an average-size adult. The actual dose can vary significantly, depending on the patient’s size and other variables.*

Is iodinated contrast (X-ray dye) safe?

Iodinated contrasts are particularly safe medications that have been used for many years with few serious side effects. Because iodinated contrast can increase the diagnostic usefulness of a CT scan, its benefits are considered to outweigh the low risk.

The most common effect of iodinated contrast is a warm or “flushed” feeling during the actual injection, sometimes with a metallic taste, that typically lasts for less than a minute. This sensation is expected and needs no treatment.

Another mild reaction is itching or “hives” over various parts of the body that can last from minutes to hours. Medications are available to help relieve the itch.

Very rarely, more significant side effects such as low blood pressure or difficulty breathing can occur shortly after contrast injection. Radiology department personnel will observe you during and for a short time after your scan to be certain that you’ve had no problem.

Even more rarely, delayed side effects, particularly rashes, can appear several hours after your scan. If you experience anything unusual, call your doctor or visit a hospital emergency department and mention that you’ve recently received intravenous contrast for a CT scan.

It is important for patients to notify their physician and CT technologist if they have had prior contrast reactions. On the rare occasions, when patients experience delayed side effects, they should phone their physician or visit an emergency care provider.

CT is particularly useful...

- When a very detailed image of bone or blood vessels is needed.
- In emergency situations, when scanning has to be quick.
- When a patient would have difficulty lying still.
- In patients with pacemakers or certain metallic implants.
- During some image-guided procedures, such as needle biopsies.

Preparation

Typically, your doctor will order a CT scan to evaluate a particular problem, and the imaging physician will then tailor the scan to answer the specific question. If the problem could be better evaluated with a different test, the imaging specialist might call your doctor to discuss other options. Before your scan begins, you'll be asked to provide information about your medical history and any previous experience with X-ray contrast ("dye").

Preparation for a CT scan depends upon which part of the body is being scanned. You might be asked to remove clothing and wear a hospital gown. Metal objects, such as jewelry, should be removed so as to not interfere with the image results. Additionally, certain dietary restrictions might be necessary, such as no food or drink for a certain period of time before the examination. Be certain your doctor is aware of all current medications you are taking before you undergo a scan. Certain medications may need to be stopped and others may be given prior to scanning.

Contrast material

Patients having a CT scan often are asked to drink a flavored liquid, or to receive an intravenous injection into their arm. These contrast materials ("X-ray dye") highlight abnormalities on the CT scan so that they are more apparent. In some cases, a CT scan can still provide valuable information without the administration of a contrast agent.

Contrast material can be introduced into the body in different ways:

By mouth – Fruit-flavored liquid contrast is very safe, and passes through the intestinal tract like regular food or drink. Side effects are uncommon. Temporary diarrhea occurs occasionally, and very rarely patients can be allergic to the iodine or flavoring in the drink.

Intravenous injection – Some patients describe a warm "flushed" sensation or a metallic taste as the contrast is being injected. These sensations typically last only a few moments and are not dangerous.

Rectal – Contrast material occasionally is administered into the rectum to evaluate colon and rectal abnormalities. Patients often experience a full sensation and more rarely cramping. A restroom is available nearby so the contrast can be eliminated promptly at the end of the examination.

Skill of the CT technologists

CT technologists have had specific training in performing these scans, and their education includes anatomy and physiology, radiation physics and safety training. In order to become certified, they must pass an examination that tests their knowledge and skill. At UK HealthCare, our CT technologists are accredited by the American Registry of Radiologic Technologists, ensuring expertise and professionalism in their area of care.

During the scan: What to expect

A CT scan is painless, but does require lying still and sometimes short periods of breath-holding. Patients with claustrophobia or difficulty remaining still may benefit from a mild sedative given before the scan.

Women should always inform their physician and CT technologist if there is any possibility that they could be or are pregnant. CT scanning is, in general, not recommended for pregnant women, unless specifically necessary, because of potential risk to the fetus. Nursing mothers should follow their doctor's advice on how long to wait after contrast material injection before resuming breast-feeding.

The scanner is shaped like a large doughnut with a table running through it. After you lie down, the table will move to the correct position for scanning the specific body part. Expect occasional clicking and buzzing sounds as the machine revolves during the actual scanning process. Although patients typically are alone in the examination room during the scan, the radiology technologist will be able to see, hear and speak with you at all times, so that any discomfort or problem can be attended to promptly.

At the conclusion of the scan, the technologist will check the images to be certain that they are adequate. Afterward, you can go on about your day as usual. If the scan included contrast material by mouth or intravenously, drinking plenty of fluids is recommended. You can return to your usual schedule of medications as soon as your scan is completed.

After the scan

Your CT scan will be interpreted by a doctor specially trained in reading advanced X-ray studies. At UK HealthCare, these imaging specialists typically have undergone additional training to become experts at reading specific types of scans, such as brain, chest, heart, abdomen and extremities. This makes them particularly well qualified to handle complex cases.

CT Scans and Children

Image Gently

Image Gently is an educational and awareness campaign created by the Alliance for Radiation Safety in Pediatric Imaging. Its goal is to provide safe, high-quality pediatric imaging nationwide. The coalition represents more than 500,000 health care professionals in radiology, pediatrics, medical physics and radiation safety.

The Image Gently campaign promotes optimal scanning strategies for children:

- Image only when there is a clear medical benefit.
- Use the lowest amount of radiation possible.
- Image only the indicated area.
- Avoid multiple scans.
- Use nonradiation studies (such as ultrasound or MRI) when possible.

UK HealthCare is proud to apply the Image Gently principles to better serve our youngest patients, but

UK HealthCare CT

UK HealthCare houses eight CT scanners, performing well over 5,000 examinations each month. These versatile machines accommodate patients from newborns to 650 pound adults.

Our CT resources include scanners that acquire 64 or 40 "slices" at once, CT fluoroscopy for guidance during biopsies, and a dual energy scanner with exciting prospects for kidney stones and heart disease.

CT scan appointments are scheduled in 15-minute time slots.

importantly, also applies this model to our adult patients as well.

A special concern for pediatric CT scanning: How to keep the little ones still

Just as in adult CT scans, having a patient who doesn't move is critical to obtaining the best quality scan for a child. Technologists use a variety of age-appropriate methods that help children hold still during a CT scan. Below is a list of the most common ways children are kept still:

- **Sandbags:** Long sandbags can keep a child's arms or legs still and correctly positioned and act as a reminder not to move.
- **Velcro straps:** Velcro bands not only immobilize the child's body, but also prevent them from falling off the table. The straps are attached to the table and are drawn snugly over the body.
- **Swaddling:** Infants and very young children might be wrapped tightly in a blanket. While some children are annoyed by the confinement, others are comforted by the security and even fall asleep.
- **Holding techniques:** At times, a child may be gently held by radiologic staff to keep a limb or body part in the correct position. If parents are asked to help hold their child, the staff will give you specific instructions so that safe radiation practices are observed.

What you can do to help

- Children may be upset or sense parental anxiety.
- Be sure to speak calmly and firmly to reassure your child.
- Praise him or her for being cooperative and helping the CT technologist.
- Feel free to ask if you can remain in the room during the test. If so, radiation safety equipment will be provided.

Resources

UK HealthCare Radiology

UK HealthCare Radiology offers a full range of state-of-the-art diagnostic imaging services for patients. We conduct imaging of patients at multiple sites. Please visit <http://ukhealthcare.uky.edu/services/radiology.htm> for more information.

Patient Appointments: 859-323-9977

Fax: 859-257-1969

American College of Radiology

1891 Preston White Drive

Reston VA 20191

Phone: 703-648-8900

www.acr.org

This health care professional membership group is dedicated to making imaging safe, effective and accessible to those who need it.

American Society of Radiologic Technologists

15000 Central Ave. SE

Albuquerque NM 87123-3909

www.asrt.org The mission of the American Society of Radiologic Technologists is to advance the medical imaging and radiation therapy profession and to enhance the quality of patient care.

MedlinePlus (CT Scans)

www.nlm.nih.gov/medlineplus/ctscans.html

HealthFinder (CT Scan)

healthfinder.gov/scripts/SearchContext.asp?topic=2686

National Cancer Institute (Computed Tomography: Questions and Answers)

www.cancer.gov/cancertopics/factsheet/Detection/CT

Related information:

- *Advances & Insights: Can noninvasive CT scans replace conventional coronary angiography?*
ukhealthcare.uky.edu/CT-angiographs
- *Advances & Insights: Studies examine radiation exposure, long-term cancer risks of CT scans*
ukhealthcare.uky.edu/CT-risks

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Call UK Health Connection at 859-257-1000 or toll free 1-800-333-8874 to make an appointment or request a referral. Visit us online at ukhealthcare.uky.edu.

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