

COMPUTED TOMOGRAPHY (CT SCAN)

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Annotation: *In this article, you can get information about computer tomography and the principle of its operation, as well as information about the situations in which its use is contraindicated.*

Key words: *CT, Contrast, Ultrafast Angiography, Combined positron emission, Radiofrequency Pulses.*

Computed tomography is commonly called CT previously known as EMI scan. Sir Godfrey Hounsfield, a British electrical engineer and biomedical engineer, invented the first computed tomography. The first CT scan of a live patient was performed on October 1, 1971 at Atkinson Morley's Hospital in Wimbledon, England. A CT scan is a diagnostic imaging procedure that uses a combination of X-rays and computer technology to create images of the inside of the body. It shows detailed images of all parts of the body, including bones, muscles, fat, organs, and blood vessels. CT scans are more detailed than standard X-rays. With standard X-rays, beams of energy are directed at the part of the body being examined. A plate behind the body part detects changes in the energy beam as it passes through the skin, bones, muscles and other tissues. Although a lot of information can be obtained from a plain X-ray, there is not much information about the internal organs and other structures.

With CT, X-rays beam travel in a circle around the body. This allows for different views of the same organ or structure and provides us with more detail. The X-ray data is sent to a computer, which interprets the X-ray data and displays it as a 2-D image on a monitor. New technologies and computer programs make it possible to create 3-D images. A CT scan



can be done to diagnose tumors, check for internal bleeding, or check for other internal injuries or damage. CT can also be used for tissue or fluid biopsies.

Computed tomography can be performed with or without contrast. Contrast refers to a substance taken orally or injected into an infusion line that makes the specific organ or tissue being examined more clearly visible. For contrast tests, you may need to fast for some time before the procedure. Before the procedure, the Physician will tell you about it.

The purpose of a computed tomography acquisition is to measure x-ray transmission through a patient for a large number of views.

CT MACHINE: It has a Gantry with X Ray tube and a row of detectors.

Most commonly used: 3rd generation CT scanner

(Tube rotation with patient translational movement)

Pitch: Table movement per rotation / slice thickness

Pitch α 1 / quality

Pitch α 1/ dose

Types Of CT Machine:

→Single detector CT

→Multiple detector CT (MDCT)(Higher speed, Better 3D/volumetric acquisition)

→Helical/ spiral CT(Higher speed,Lower dose)

HOUNSFIELD UNIT:

Gives objective measurement of blackness / whiteness

The more the number in minus the black appearance.

Air	Fat	Distilled water	Soft tissue	Acute hemorrhage	Iodinated contrast	Bone/ Ca ²⁺
-1000	-10 to -100	0	20-30	60-90	100-300	1000



CT is the best, fast and cheap way to identify various injuries within various regions of the body.

How to prepare for a CT scan?

If you are having a computed tomography angiography (CTA) or virtual colonoscopy, you will receive specific instructions at your appointment.

CLOTHING: You may be asked to wear modest clothing. In this case, you get a shirt. Please remove all piercings and leave all jewelry and valuables at home or you will be given a locker to store your belongings in some hospitals.

CONTRAST AGENT: Contrast may be indicated for your exam. A contrast agent improves the radiologist's ability to find abnormal structures and better understand normal anatomy. Tell your radiologist in advance if you have kidney problems. Some patients should not have an iodine-based contrast agent as it may cause allergy. So We may do a non-contrast scan or find an alternative imaging exam.

The most common type of contrast-enhanced CT scan is a double-contrast study, in which contrast material is given in addition to IV contrast before the exam begins. The more contrast that can be ingested, the better images the radiologist can use to visualize the digestive tract.

ALLERGIES: If you have an allergic reaction to contrast media, please tell the Access Center representative when you schedule your scan. IV contrast medium is not given if there has been a history of severe or anaphylactic reaction to contrast media. Mild to moderate reactions require a plan that includes medication before the CT scan. These plans will be discussed in detail with you when planning the exam. Any known reactions to the contrast agent should be discussed with your personal physician.

Eating and drinking: When the study is ordered. On the contrary, you can eat, drink and take the prescribed medicine before the exam. When the doctor orders a CT scan. On the contrary, you should not eat anything three hours before the CT scan. We recommend that you drink clear liquids. You can also take your prescribed medication before the exam.

DIABETES: People with diabetes should eat a light breakfast or lunch three hours before the scan. Depending on the type of oral diabetes



medication you are taking, you may be asked to stop taking the medication for 48 hours after the CT scan. You will receive detailed instructions after the exam.

MEDICATION: All patients can take their prescribed medication as usual.

What are the risks of CT scans?

You should tell your doctor if you are pregnant or think you may be pregnant. The radiation dose used in CT scans is low. You can ask your doctor about the amount of radiation used during a CT scan and the risks associated with your particular situation. If you are claustrophobic or easily anxious, let your doctor know in advance. You may be given a mild sedative before the procedure to help you feel comfortable.

What happens during a CT scan?

A CT scan can be done on an outpatient basis or as part of a hospital stay. Procedures may vary depending on your condition and your doctor's practice. In general, a CT scan involves the following process: You may be asked to wear a patient gown. In this case, you get a shirt. There is a wardrobe to store all personal belongings. Please remove all piercings and leave all jewelry and valuables at home. If you are having a contrast procedure, an IV line will be started in your hand or arm to inject contrast material. For oral contrast, you will receive a liquid contrast medium that you can swallow. In some cases, contrast may be given rectally. They lie on a scanning table that goes into a large, round hole in the scanner. The technician is in another room where the scanner controls are located. However, you are always in the technologist's field of view through the window. The technician can communicate with you and hear you through the speakers on the scanner. If you run into problems during the process, there may be a call button to notify the technician. A technologist will monitor and communicate with you at all times. As the scanner rotates around you, x-rays will be sent through your body for a short period of time. You will hear normal clicking sounds. X-rays absorbed by body tissues are recorded by the scanner and transmitted to a computer. The computer converts the information into an image for the radiologist to interpret. It is very important that you remain calm during the procedure. You may be asked to hold your breath at various times during the



procedure. If contrast medium is used in the procedure, some effects may occur when the contrast is injected into the infusion line. These effects include flushing, a salty or metallic taste in the mouth, a brief headache, or nausea and/or vomiting. These effects usually last a few minutes. If you have difficulty breathing, sweating, sleepiness, or a heartbeat, you should notify the specialist. When the procedure is over, you will be removed from the scanner. If an IV line with contrast is inserted, the line is erased. Although the CT procedure itself is not painful, lying still may cause discomfort or pain throughout the procedure, especially if you have a recent injury or an invasive procedure such as surgery. The specialist will take all comfort measures and complete the procedure as soon as possible to minimize discomfort or pain.

What happens after a CT scan?

If contrast media is used during the procedure, you may be observed for a period of time for side effects or reactions to the contrast, such as itching, swelling, rash, or difficulty breathing. If you return from the procedure, pain, redness, and/or swelling around the IV site or swelling, you should tell your doctor, as this may indicate an infection or other type of reaction. After a CT scan, no special care is usually required. Unless your doctor advises you otherwise, you can continue with your normal diet and activities. Your doctor may give additional or alternative instructions depending on your condition after the procedure.

HIGH-DEFINITION CT: This type of CT exam uses very thin slices (less than 0.1 inches) that can be seen under certain conditions, such as:
B. allowing for clearer imaging of lung disease.

HELICAL OR SPIRAL CT: During this type of CT scan, both the patient and the X-ray beam are constantly moving, with the X-ray beam moving around the patient. Images are taken faster than standard CT scans. The resulting images have high resolution, high contrast and detailed information. Multi-line detector Helix CT scanners can be used to obtain information about calcium buildup in the coronary arteries of the heart.

ULTRAFAST CT: (also known as electron beam CT): This type of CT scan creates very fast images and creates a unique "film" of moving parts of the body, such as the heart's chambers and valves. This scan can also



be used to get information about calcium build-up in the coronary arteries of the heart, but spiral scans are more common.

COMPUTED TOMOGRAPHY ANGIOGRAPHY (CTA): Angiography (or arteriography) is an X-ray of the blood vessels. A CT angiogram uses CT technology instead of standard X-rays or fluoroscopy to take pictures of blood vessels, such as the heart's coronary arteries.

COMBINED POSITRON EMISSION TOMOGRAPHY and CT (PET/CT): The combination of CT and positron emission tomography technologies in a single machine is called PET/CT. PET/CT combines the ability of CT to provide detailed anatomy to show cellular function and metabolism for more accurate diagnosis and treatment of certain types of disease, especially cancer. PET/CT can also be used to evaluate conditions such as epilepsy, Alzheimer's, and coronary artery disease.

MR TOMOGRAPHY: The working principle of Magnetic Resonance Tomography It is a medical imaging method used in radiology to describe the anatomy and physiological processes of the body and to diagnose diseases. MRI is a method of beam diagnosis based on the use of magnetic field and radio waves to obtain layered and volumetric images of organs and tissues restored by mathematical methods. Unlike radio wave methods, MRI uses radio waves that are much lower in frequency than needed to ionize atoms. MRT does not have an ionizing (harmful) effect on biological tissues and is currently considered almost harmless. The main contraindications during the study are the static magnetic field around the magnet (also called the peripheral magnetic field) on metal objects (ferromagnetic materials). related to the effect. Metal objects should not be affected by this field (they can be both outside and inside the patient), because the risk of attracting such objects increases significantly when approaching the magnet. In addition to the main magnet, radio frequency pulses are also transmitted to various parts of the patient's body. affects various electronic devices, for example, cardiac implants (rhythm drivers, pacemakers). Scientifically confirmed data about the negative effects of static magnetic fields on living organisms have not yet been obtained, and there is no information about the teratogenic effects of magnetic fields on the fetus. no evidence whatsoever. However, pregnancy is often a relative contraindication for MRI, especially in the first trimester of pregnancy.



Relative contraindications are claustrophobia (panic attacks in the device tunnel may not allow studying), as well as a very severe condition of the patient that requires physiological monitoring.

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