Computed Tomography (CT) - Abdomen/Pelvis

This procedure is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas.

What is CT Scanning of the Abdomen and Pelvis?

CT scanning—sometimes called CAT scanning—is a noninvasive, painless medical test that helps physicians diagnose and treat medical conditions.

CT imaging uses special x-ray equipment to produce multiple images or pictures of the inside of the body and a computer to join them together in cross-sectional views of the area being studied. The images can then be examined on a computer monitor or printed.

CT scans of internal organs, bone, soft tissue and blood vessels provide greater clarity than conventional x-ray exams.

What are some common uses of the procedure?

A CT scan of the abdomen is typically used to help diagnose the cause of abdominal pain and diseases of the bowel and colon, such as:

- abscesses in the abdomen
- inflamed colon
- cancers of the colon, liver, pancreas and kidneys
- pancreatitis
- lymphoma
- staging for cancer
- diverticulitis
- appendicitis

CT scanning of the abdomen is also performed to:

- visualize the liver, spleen, pancreas and kidneys
- plan and properly administer radiation treatments for tumors
- guide biopsies and other minimally invasive procedures

CT imaging can also play a significant role in the detection, diagnosis and treatment of vascular disorders that can lead to stroke, gangrene or kidney failure.

How should I prepare?

You should wear comfortable, loose-fitting clothing to your exam. You may be given a gown to wear during the procedure.

Metal objects including jewelry, eyeglasses, dentures and hairpins may affect the CT images and should be left at home or removed prior to your exam. You may also be asked to remove hearing aids and removable dental work.

You may be asked not to eat or drink anything for several hours beforehand, especially if a contrast material will be used in your exam. You should inform your physician of any medications you are taking and if you have any allergies, especially to contrast materials.

Also inform your doctor of any recent illnesses or other medical conditions, and if you have a history of heart disease, asthma, diabetes, kidney disease or thyroid problems. Any of these conditions may increase the risk of an unusual adverse effect.

Women should always inform their physician or technologist if there is any possibility that they are pregnant.

What does the equipment look like?

The CT scanner is typically a large machine with a hole, or tunnel, in the center. A moveable examination table slides into and out of this tunnel. In the center of the machine, the x-ray tube and electronic x-ray detectors are located opposite each other on a ring, called a gantry, which rotates around you. The computer that processes
How does the procedure work?

In many ways CT scanning works very much like other x-ray examinations. X-rays are a form of radiation—like light or radio waves—that can be directed at the body. Different body parts absorb the x-rays in varying degrees.

In a conventional x-ray exam, a small burst of radiation is aimed at and passes through the body, recording an image on photographic film or a special image recording plate. Bones appear white on the x-ray; soft tissue shows up in shades of gray and air appears black.

With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around you, measuring the amount of radiation being absorbed throughout your body. At the same time, the examination table is moving through the scanner, so that the x-ray beam follows a spiral path. A special computer program processes this series of pictures, or slices of your body, to create two-dimensional cross-sectional images, which are then displayed on a monitor.

CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body’s interior.

Refinements in detector technology allow new CT scanners to obtain multiple slices in a single rotation. These scanners, called “multislice CT” or “multidetector CT,” allow thinner slices to be obtained in a shorter period of time, resulting in more detail and additional view capability.

Modern CT scanners are so fast that they can scan through large sections of the body in just a few seconds. Such speed is beneficial for all patients but especially children, the elderly and critically ill.

For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied.

How is the procedure performed?

The technologist begins by positioning you on the CT examination table, usually lying flat on your back or possibly on your side or on your stomach. Straps and pillows may be used to help you maintain the correct position and to hold still during the exam.

If a contrast material is used, it will be swallowed, injected through an intravenous line (IV) or administered by enema, depending on the type of examination.

Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed.

You may be asked to hold your breath during the scanning.

When the examination is completed, you will be asked to wait until the technologist determines that the images are of high enough quality for the radiologist to read.

The CT scanning is usually completed within 30 minutes.

What will I experience during and after the procedure?

Most CT exams are painless, fast and easy. With spiral CT, the amount of time that the patient needs to lie still is reduced.

Though the scanning itself causes no pain, there may be some discomfort from having to remain still for several minutes. If you have a hard time staying still, are claustrophobic or have chronic pain, you may find a CT exam to be stressful. The technologist or nurse may offer you a mild sedative to help.

If an intravenous contrast material is used, you will feel a slight pin pricking when the needle is inserted into your vein. You may have a warm, flushed sensation during the injection of the contrast materials and a metallic taste in your mouth that lasts for a few minutes. Occasionally, a patient will develop itching and hives, which can be relieved with medication. If you become light-headed or experience difficulty breathing, you should notify the technologist or nurse, as it may indicate a more severe allergic reaction.
If the contrast material is swallowed, you may find the taste mildly unpleasant; however, most patients can easily tolerate it. You can expect to experience a sense of abdominal fullness and an increasing need to expel the liquid if your contrast material is given by enema. In this case, be patient, as the mild discomfort will not last long.

Many patients also receive iodine intravenously (injected into a vein) to help evaluate blood vessels and organs such as the liver, kidneys and pancreas.

When you enter the CT scanner, special lights may be used to ensure that you are properly positioned. With modern CT scanners, you will hear only slight buzzing, clicking and whirring sounds as the CT scanner revolves around you during the imaging process.

You will be alone in the exam room during the CT scan, however, the technologist will be able to see, hear and speak with you at all times.

With pediatric patients, a parent may be allowed in the room but will be required to wear a lead apron to prevent radiation exposure.

After a CT exam, you can return to your normal activities. If you received a contrast material, you may be given special instructions.

Who interprets the results and how do I get them?

A radiologist, a physician specifically trained to supervise and interpret radiology examinations, will analyze the images and send a signed report to your primary care or referring physician, who will share the results with you.

What are the benefits vs. risks?

Benefits

- Viewing a CT scan, an experienced radiologist can diagnose many causes of abdominal pain with very high accuracy, enabling faster treatment and often eliminating the need for additional, more invasive diagnostic procedures.
- When pain is caused by infection and inflammation, the speed, ease and accuracy of a CT examination can reduce the risk of serious complications caused by a burst appendix or ruptured diverticulum and the subsequent spread of infection.
- CT scanning is painless, noninvasive and accurate.

- A major advantage of CT is that it is able to image bone, soft tissue and blood vessels all at the same time.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.
- CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.
- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT may be less expensive than MRI. In addition, it is less sensitive to patient movement.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- CT imaging provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones.
- A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy.
- No radiation remains in a patient’s body after a CT examination.
- X-rays used in CT scans usually have no side effects.

Risks

- There is always a slight chance of cancer from radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- The effective radiation dose from this procedure is about 10 mSv, which is about the same as the average person receives from background radiation in three years.
- Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant.
- CT scanning is, in general, not recommended for pregnant women because of potential risk to the baby.
- Nursing mothers should wait for 24 hours after intravenous contrast material injection before resuming breast-feeding.
The risk of serious allergic reaction to contrast materials that contain iodine is rare, and radiology departments are well-equipped to deal with them.

Children should have a CT study only if it is essential for making a diagnosis and should not have repeated CT studies unless absolutely necessary.

What are the limitations of CT Scanning of the Abdomen and Pelvis?

A person who is very obese may not fit into the opening of a conventional CT unit.

CT Scanning of the abdomen may not be as sensitive in identifying gallstones as ultrasound of the abdomen.

For some conditions, including but not limited to some liver, adrenal and pancreatic abnormalities, the evaluation and diagnosis with MRI may be preferable over CT scanning.

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Appendicitis: The appendix (A) is distended and inflamed. In this patient the appendix has not yet ruptured.