X-rays and Other Radiographic Tests for Cancer

X-rays and other radiographic tests (also known as **radiographs**, **roentgenograms**, and **contrast studies**) help doctors look for cancer in different parts of the body including bones, and organs like the stomach and kidneys. X-rays are typically fast, painless, and there's no special preparation needed. Contrast studies may require more preparation ahead of time and may cause some discomfort and side effects, depending on what kind you are having. (For names of contrast studies, see Table 1.)

What do x-rays show?

Radiographs, most often called x-rays, produce shadow-like images of bones and certain organs and tissues. X-rays are very good at finding bone problems. They can show some organs and soft tissues, but MRI and CT scans often give better pictures of them. Still, x-rays are fast, easy to get, and cost less than other scans, so they might be used to get information quickly.

Mammograms (breast x-rays) are a form of radiographic tests. To learn more about them, see Mammogram Basics[1].

Special types of x-ray tests called **contrast studies** use iodine-based dyes or contrast materials, like barium, along with the x-rays to make the organs show up on the x-ray and get better pictures. For instance, a lower gastrointestinal (GI) series, often called a **barium enema** exam, takes x-ray pictures after the bowel is filled with barium sulfate. Another contrast study, an **intravenous pyelogram** (IVP), uses a special dye to look at the structure and function of the urinary system (ureters, bladder, and kidneys). See Table 1 for more examples.

Due to advances in technology, many contrast studies are being replaced by other scans, such as CT[2] or MRI scans[3]. For instance, in the past, angiography was often used to help learn the stage or extent of cancer, but now CT and MRI scans are most often used to do this. Still, angiography is sometimes used to show the blood vessels next to a cancer so surgery can be planned to limit blood loss. And angiograms may be used to diagnose non-cancerous blood vessel diseases.

How do x-rays work?

A special tube inside the x-ray machine sends out a controlled beam of radiation. Tissues in the body absorb or block the radiation to varying degrees. Dense tissues such as bones block most radiation, but soft tissues, like fat or muscle, block less. After passing through the body, the beam hits a piece of film or a special detector. Tissues that block high amounts of radiation, such as bone, show up as white areas on a black background. Soft tissues block less radiation and show up in shades of gray. Organs that are mostly air (such as the lungs) normally look black. Tumors are usually denser than the tissue around them, so they often show up as lighter shades of gray.

Contrast studies provide some information that standard x-rays cannot. During a contrast study, you get a contrast material that outlines, highlights, or fills in parts of the body so that they show up more clearly on an x-ray. The contrast material may be given by mouth, as an enema, as an injection (put in a vein), or through a catheter (thin tube) put into various tissues of the body. It will look bright white on the x-ray and outline the body part. For most of these tests, the images can be captured either on x-ray film or by a computer.

Table 1: Commonly Used Contrast Studies

Test name(s)	**Organs studied**	**Dye is given by**
Angiography, angiogram, arteriography, arteriogram	Arteries throughout the body, including those in	Catheter (thin tube)

You may have special shields put over parts of your body near the area being x-rayed so that they're not exposed to the radiation. Usually the technologist leaves the room to operate the machine by remote control. But they can hear and see you at all times. Your exposure to the x-ray is very brief – usually less than a second. You may hear buzzing or clicking sounds while the machine is working.

For a **chest x-ray**, often 2 views are taken. First, you stand with your chest against the x-ray film and the image is taken from the back. Your arms are at your side. Then a side view is often taken with your arms either above your head or in front of you. The technologist will tell you when to take a deep breath and hold still. For a chest x-ray in people who can't stand, the film is put under them and the picture is taken from the front.

During an **abdominal (belly) x-ray**, you lie down on a table. You may be asked to change position or sit up if more than one view is needed. You'll need to hold your breath and lie still while the picture is taken quickly.

After the x-ray, the technologist will come back to the room to move the machine out of the way, remove any protective shields, collect the film, and help you back to the changing room where you can get dressed.

Contrast studies

Angiography: You'll be asked to not eat before this test. In most cases, you'll be given medicine to relax you before the test starts. You will lie still on a table as the skin over the injection site is cleaned and numbed. A tiny cut will be made so the catheter (thin plastic tube) can be put into a blood vessel (usually the artery at the top of the thigh) and slid in until it reaches the area to be studied. The contrast dye is then put in, and a series of x-ray pictures is taken to see how the dye flows through the blood vessels. After that, the catheter is taken out.

Firm pressure might be needed on the catheter site for a while to make sure it doesn't bleed. You'll also need to lie flat and keep your leg still for up to several hours. This helps prevent bleeding at the catheter site, too.

Other types of angiography: Advances in technology have led to other forms of angiography that take less time and mean fewer risks than x-ray angiography. *CT angiography* takes pictures of blood vessels using a CT scanner instead of a standard x-ray machine. The contrast dye can be put into a small vein in the arm instead of having to put a catheter into a major blood vessel. **Magnetic resonance angiography** (MpheA ca taay 5Qr forms of

Intravenous pyelogram (IVP): You'll probably be asked not to eat or drink anything for about 12 hours before this test, and you must take laxatives to clean out your bowel. For the test itself, you lie on a table for a series of x-rays. Contrast dye is then out into a vein in your arm. Your kidneys remove the dye from the bloodstream, and it goes into the urinary tract. Another series of x-rays is taken over the next 30 minutes or so to get pictures of the dye as it moves through the kidneys and out of your body. Pressure may be applied to the belly to help make the image clearer. Once the dye has reached the bladder, you'll be asked to pass urine while another x-ray is taken.

Lower GI series (barium enema): Your diet may be restricted for a few days before this test. Laxatives and/or enemas are used to clean out the bowel (large intestine). For the test, you lie down and are strapped to a table. A series of x-rays is taken. Then liquid barium is put into your bowel through a small, soft tube placed in your rectum. The liquid feels cool. More images are then taken while the table tilts you into different positions. This helps the barium move through your bowels so they can be seen on the x-rays. You have to lie still and hold your breath as each image is taken.

After the test, you can go to the toilet to pass the barium solution out of your bowels. (It may take a few days until it's all out. Your stool may be drier, harder, and light-colored during this time.)

To get clearer pictures, a "double-contrast" exam is often done. This exam uses a smaller amount of thicker barium liquid. After the barium is in, air is put into your bowel. This can cause a sense of fullness and discomfort, along with an urge to empty your bowels.

Upper GI series: You will probably be asked to not eat or drink for 8 to 12 hours before this test. You will lie down and be strapped to a tilting table while a series of x-rays are taken as the barium coats your esophagus and stomach. You'll need to swallow the barium mixture a few times during the test. (In some cases, substances other than barium are used.) You might also be asked to swallow baking soda crystals to create gas in your stomach.

Sometimes more pictures are taken a few hours later to show the small intestine (it takes time for the barium to move from the stomach to the small intestine). This is called a **small bowel follow through**.

After the test you may be given a laxative to speed up getting the barium out of your body. It still may take a few days until it's all out. Your stool may be drier, harder, and light-colored during this time.

Venography: As you lie still on a table, the skin over the vein to be used is cleaned and

numbed. This will be a small vein below the vein that might be blocked (like the foot for a vein in the leg, or the hand for a vein in the arm). A catheter (thin plastic tube) is then put into the small vein. It may be threaded in so that it passes into a larger vein closer to the one to be studied, or a tourniquet may be used so the dye flows into the deeper veins. The contrast dye is put in to make the veins show up on the x-ray, and a series of x-ray pictures is taken.

Extra fluids may be given through the catheter to help wash the dye out of your body. After that, the catheter is taken out. Firm pressure may be needed on the site for a while to make sure it doesn't bleed.

How long do x-rays take?

- Standard x-ray: about 5 to 10 minutes
- Angiogram: 1 to 3 hours
- Intravenous pyelogram: about 1 hour
- Lower GI series: 30 to 45 minutes
- Upper GI series: 30 minutes to 6 hours, depending on the part of the digestive system being tested
- Venogram: 30 to 90 minutes

What are the possible complications and side effects of x-rays?

Standard x-rays: Problems are rare and very unlikely.

Angiography: You may have a warm or burning feeling as the dye is given. The contrast material may cause nausea, vomiting, flushing, itching, or a bitter or salty taste. In rare cases, people can have a severe allergic reaction to the contrast material that affects their breathing and blood pressure. The contrast material can also cause kidney problems. This is rare, but it's more common in someone whose kidneys already don't work well.

There's a small risk of a blood clot forming on the end of the catheter, which could block a blood vessel. There's also a small risk of damage to the blood vessel from the catheter, which could lead to internal bleeding. A hematoma (a large collection of blood under the skin) may develop where the catheter was put in if pressure is not kept on the site long enough. Infection is possible at the catheter site. (Possible complications of CT or MR angiography are like those described in the sections on CT and MRI).

Your body may ache from lying still on the flat table for a few hours.

Intravenous pyelogram (IVP): The contrast dye sometimes causes some people to have flushing, mild itching, or a bitter or salty taste. In rare cases, people have a severe reaction to the contrast material and need emergency treatment.

Lower GI series (barium enema): The test can be uncomfortable. Some patients have abdominal (belly) cramping. Many patients find the test makes them tired. The barium contrast material will make your stools a light color for a few days after the test and may cause constipation. Very rarely, the barium can cause an obstruction, or blockage, in the bowels.

Upper GI series (barium swallow): The barium mixture has the thickness of a milkshake and tastes chalky. Baking soda crystals can cause bloating, gas, and belching. After the test, your stools will be a light color for a few days, and you may be constipated. There's a slight chance that the barium might cause an obstruction or blockage in the intestine.

Venography: You may have a warm or burning feeling as the dye is given. Your arm or leg (where the catheter is put in) may feel numb during the test. Some people have a bitter or salty taste in their mouth. In rare cases, people can have a severe allergic reaction to the contrast material that affects their breathing and blood pressure. The contrast material can also cause kidney problems. This is rare, and it's more common in someone whose kidneys already don't work well.

There's a small risk of a blood clot forming, which could block a blood vessel. There's also a small risk of damage to the blood vessel from the catheter, which could lead to internal bleeding. There may be pain and bruising and infection is possible where the catheter is put in.

medical offices or hospitals.
- If you are to have a test that uses a contrast dye, tell your doctor if you are allergic to contrast materials, iodine, or to seafood. This may put you at a higher risk for having a reaction.

Hyperlinks

1. www.cancer.org/cancer/types/breast-cancer/screening-tests-and-early-detection/mammograms/mammogram-basics.html
2. www.cancer.org/cancer/diagnosis-staging/tests/imaging-tests/ct-scan-for-cancer.html
3. www.cancer.org/cancer/diagnosis-staging/tests/imaging-tests/mri-for-cancer.html

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American College of Radiology/Radiological Society of North America. *Venography*. June 23, 2015. Accessed at www.radiologyinfo.org/en/info.cfm?pg=Venography on November 18, 2015.

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