

*Nuclear Medicine  
Patient Prep  
Information*



Cannon Memorial Hospital  
Watauga Medical Center

<b>Table Weight Limits for each facility</b>		
	<b>Cannon Memorial Hospital</b>	<b>Watauga Medical Center</b>
MRI 1 (High Field)	350 lbs.	440 lbs.
MRI 2 (Open)		490 lbs.
CT 1 (VCTXT)		500 lbs.
CT 2		450 lbs.
CT Scan Table	450 lbs.	
Diagnostic x-ray room 1	300 lbs.	300 lbs.
Diagnostic x-ray room 2		300 lbs.
Diagnostic x-ray room 3		300 lbs.
Diagnostic ER x-ray		460 lbs.
Nuclear Medicine	400 lbs.	440 lbs.
Ultrasound		500 lbs.
Ultrasound Stretcher	500 lbs.	
Outpatient/Lab Center X-ray		460 lbs.
Dexa scan		350 lbs.
Dexa table	300 lbs.	

## **Scheduling / General information**

- All Imaging exams must be scheduled with the scheduling department with exception to some diagnostic radiology exams.
- To schedule an appointment please contact our scheduling department at 828-268-9037 between the hours of 8:00am-5:00pm. If you reach the voicemail please leave a detailed message and someone will answer your call as soon as possible.
- On the day of your exam please arrive 15 minutes prior to your exam time to register at outpatient registration.
- To have an imaging exam done there must be a physicians order.
- According to the patient preps for certain exams, lab results should be available prior to the exam.

**If you have any questions about your exam please call the Imaging Department**

**Watauga Medical Center:** (828) 262-4153

**Watauga Medical Outpatient Imaging/Lab Center:**  
(828) 266-2498

**Cannon Memorial Hospital:** (828) 737-7620

## **General description of each Imaging department**

- **Radiography (“X-Ray”)** – Uses x-rays to create images.

X-rays created in an x-ray tube pass through a patient to reach the ‘image receptor’ (‘cassette’). The cassette is then inserted into a computed radiography ‘reader’ that converts the energy absorbed by that cassette into a visible image seen on a computer. Radiography best visualizes bones, lungs, and contrast-filled organs (i.e. GI tract, kidneys). Radiography can be used in conjunction with or to enhance another modality, i.e. injecting a joint with contrast before an MRI is obtained or injecting contrast into the spinal canal before a CT is obtained. The contrast media used is usually barium, iodine, or air, depending on the study being performed.

- **Computed Tomography (“CT”)** – Uses x-rays to create images.

Multiple x-rays of ‘slices’ or planes of the body are obtained and reconstructed by a computer to form an image. CT is frequently performed for patients with trauma, kidney stones, cardiac issues, suspected stroke or pulmonary embolism, or abdominal pain. Biopsies are also frequently performed using CT to guide the radiologist. The contrast media used can be orally-ingested barium, IV iodine, or rectally-induced air, depending on the area to be imaged. CT can be used to visualize bone or soft tissue.

- **Magnetic Resonance Imaging (“MRI”)** – Uses a strong magnetic field and radio waves to create images. The patient lies on a table within a strong magnetic field with a ‘coil’ placed over the body part of interest. The body emits ‘signals’ in response to changes in the magnetic fields, which are transmitted by the coil to a computer. The computer converts these signals to images of planes (‘slices’) of the body. Gadolinium is the most frequently used contrast agent used. MRI is best for visualization of soft tissues.

- **Ultrasound (“Sonography”)** – Uses sound waves to create images. High-frequency sound waves are sent through the patient’s body and the ‘echoes’ are converted by a computer into images. The patient may be asked to be NPO or have a full bladder so that these ‘echoes’ may be enhanced. Ultrasound is often used to guide biopsies of soft tissue organs. Ultrasound is used to visualize soft tissue structures.

- **Nuclear Medicine** – Uses ingested or injected radioactive materials to create images. The patient is given either an orally or intravenously administered radioisotope that targets a specific part of the body. The patient is then (after a specified period of time) placed under a ‘camera’ which detects the radiation emitted by the patient’s body. A computer then converts those detections to an image. Nuclear medicine is used to assess a specific system function and is not used to image anatomy.

- **Mammography** – Uses x-rays to create images of the breast. X-rays are produced in an x-ray tube, which pass through a patient’s breast to a detector. The detector absorbs the x-rays and converts them to an electrical signal which is then converted by a computer into an image. It is used as a screening exam for detection of breast cancer and also for diagnosis of breast lumps, microcalcifications, etc. It may also be used to guide placement of localization devices such as wires or needles in a breast prior to surgery, as well as to image breast tissue removed during surgery. Watauga Medical Center only offers mammography at Outpatient Imaging/Lab Center. Cannon Memorial does mammography at the hospital.

- **Bone Densitometry (“Dexa”)** – Uses x-rays to measure bone density. A ‘pencil-beam’ (tightly restricted x-ray beam) is used to scan the lower back and the hip. The beam passes through the body and a detector absorbs the energy of the x-ray beam. That energy is then converted to a non-diagnostic image and a numerical value, providing a calculation of bone density. That calculation is also compared to other age groups and to previous scans a patient may have had. This modality is only used to diagnose osteoporosis or osteopenia. There is not a preparation prior to this exam. Watauga Medical Center only offers Dexa scans at the Outpatient Imaging/Lab Center. Cannon Memorial offers Dexa scans at the hospital.

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## Radioactive Iodine Therapy - THYROID CANCER

(Performed only at Watauga Medical Center)

*Radioactive iodine (I-131) therapy is a treatment for papillary or follicular thyroid cancer. It kills thyroid cancer cells and normal thyroid cells that remain in the body after surgery.*

*People with medullary thyroid cancer or anaplastic thyroid cancer usually do not receive I-131 therapy. These types of thyroid cancer rarely respond to I-131 therapy.*

*Even people who are allergic to iodine can take I-131 therapy safely. The therapy is given as a liquid or capsule that you swallow. I-131 goes into the bloodstream and travels to thyroid cancer cells throughout the body. When thyroid cancer cells take in enough I-131, they die.*

*Many people get I-131 therapy in a clinic or in the outpatient area of a hospital and can go home afterward. Some people have to stay in the hospital for one day or longer. Ask your health care team to explain how to protect family members and coworkers from being exposed to the radiation.*

*Most radiation from I-131 is gone in about one week. Within three weeks, only traces of I-131 remain in the body.*

*During treatment, you can help protect your bladder and other healthy tissues by drinking a lot of fluids. Drinking fluids helps I-131 pass out of the body faster.*

*Some people have mild nausea the first day of I-131 therapy. A few people have swelling and pain in the neck where thyroid cells remain. If thyroid cancer cells have spread outside the neck, those areas may be painful too.*

*You may have a dry mouth or lose your sense of taste or smell for a short time after I-131 therapy. Chewing sugar-free gum or sucking on sugar-free hard candy may help.*

*A rare side effect in men who receive a high dose of I-131 is loss of fertility. In women, I-131 may not cause loss of fertility, but some doctors advise women to avoid getting pregnant for one year after a high dose of I-131.*

*Researchers have reported that a very small number of patients may develop a second cancer years after treatment with a high dose of I-131.*

*A high dose of I-131 also kills normal thyroid cells, which make thyroid hormone. After radioactive iodine therapy, you need to take thyroid hormone pills to replace the natural hormone.*

## **Thyroid Ablation - Hyperthyroidism**

**(performed only at Watauga Medical Center)**

*Radioactive Iodine I-131 (also called Radioiodine I-131) therapy is a treatment for an overactive thyroid, a condition called hyperthyroidism.*

*The thyroid is a gland in the neck that produces two hormones that regulate all aspects of the body's metabolism, the process of converting food into energy. When a thyroid gland is overactive, it produces too much of these hormones, accelerating the body's metabolism. Symptoms of this condition include an enlarged thyroid gland, rapid heart rate, high blood pressure, weight loss in spite of increased appetite and less tolerance for a warm environment.*

*Radioactive iodine (I-131) is an isotope created from iodine to emit radiation for medical use. When a small dose of I-131 is swallowed, it is absorbed into the bloodstream in the gastrointestinal (GI) tract and concentrated from the blood by the thyroid gland, where it begins destroying the gland's cells. This treatment causes thyroid activity to slow considerably and in some cases, may turn an overactive thyroid into an underactive thyroid requiring additional treatment.*

*Radioactive iodine I-131 may also be used to treat Graves' disease, goiter, thyroid nodules, and thyroid cancer.*

### **Who will be involved in this procedure?**

*A radiologist who has specialized training in nuclear medicine and others, possibly including an endocrinologist, oncologist, thyroid surgeon and radiation safety officer, will be part of your treatment team.*

### **What equipment is used?**

*There is no equipment used during radioactive iodine therapy.*

### **Who operates the equipment?**

*There is no equipment used during radioactive iodine therapy, the patient simply swallows a prepared dose.*

### **Is there any special preparation needed for the procedure?**

*You will be able to return home following radioactive iodine treatment, but you should avoid prolonged, close contact with other people for several days, particularly pregnant women and small children. Nearly all the radioactive iodine leaves the body during the first two days following the treatment, primarily through the urine. Small amounts will also be excreted in saliva, sweat, tears, vaginal secretions, and feces.*

*If your work or daily activities involve prolonged contact with small children or pregnant women, you will want to wait several days after your treatment to resume these activities. Patients with infants at home should arrange for care to be provided by another person for the first several days after treatment.*

*Your treatment team will give you a list of other precautions to take following your treatment with I-131. These guidelines comply with the Nuclear Regulatory Commission. Patients who need to travel immediately after radioactive iodine treatment are advised to carry a letter of explanation from their physician. Radiation detection devices used at airports and federal buildings may be sensitive to the radiation levels present in patients up to three months following treatment with I-131.*

*The guidelines include these recommendations:*

- *Use private toilet facilities, if possible; and flush twice after each use.*
- *Bathe daily and wash hands frequently.*
- *Drink normal amount of fluids.*
- *Use disposable eating utensils or wash your utensils separately from others.*
- *Sleep alone and avoid prolonged intimate contact. Brief periods of close contact, such as handshaking and*

*hugging, are permitted.*

- *Launder your linens, towels, and clothes daily at home, separately. No special cleaning of the washing machine is required between loads.*
- *Do not prepare food for others that requires prolonged handling with bare hands.*

*Depending on the amount of radioactivity administered during your treatment, your endocrinologist or radiation safety officer may recommend continued precautions for up to several weeks after treatment.*

*Radioiodine should never be used in a patient who is pregnant or nursing. I-131 given during pregnancy can damage the baby's thyroid gland. When given to a nursing mother, radioactive iodine can reach a baby through her breast milk. Most physicians feel that this procedure should not be used in women who are breast feeding who are unwilling to cease breast feeding their newborn completely. Also, pregnancy should be put off until at least six to 12 months after I-131 treatment, since the treatment exposes the ovaries to radiation.*

*Women who have not yet reached menopause should fully discuss the use of I-131 with their physician.*

### **How is the procedure performed?**

*Treatment for hyperthyroidism is almost always done on an outpatient basis because the dose required is relatively small.*

*The radioiodine I-131 is swallowed in a single dose, in capsule or liquid form, and is quickly absorbed into the bloodstream in the gastrointestinal (GI) tract and concentrated from the blood by the thyroid gland, where it begins destroying the gland's cells. Although the radioactivity from this treatment remains in the thyroid for sometime, it is greatly diminished within a few days.*

*Its effect on the thyroid gland usually takes between one and three*

months to develop, with maximum benefit occurring three to six months after treatment.

### **What will I feel during this procedure?**

*It is common for patients to experience some pain in the thyroid after I-131 treatment for hyperthyroidism. You should ask your physician to recommend an over-the-counter pain reliever to treat this pain.*

### **Are there permanent side effects from the procedure?**

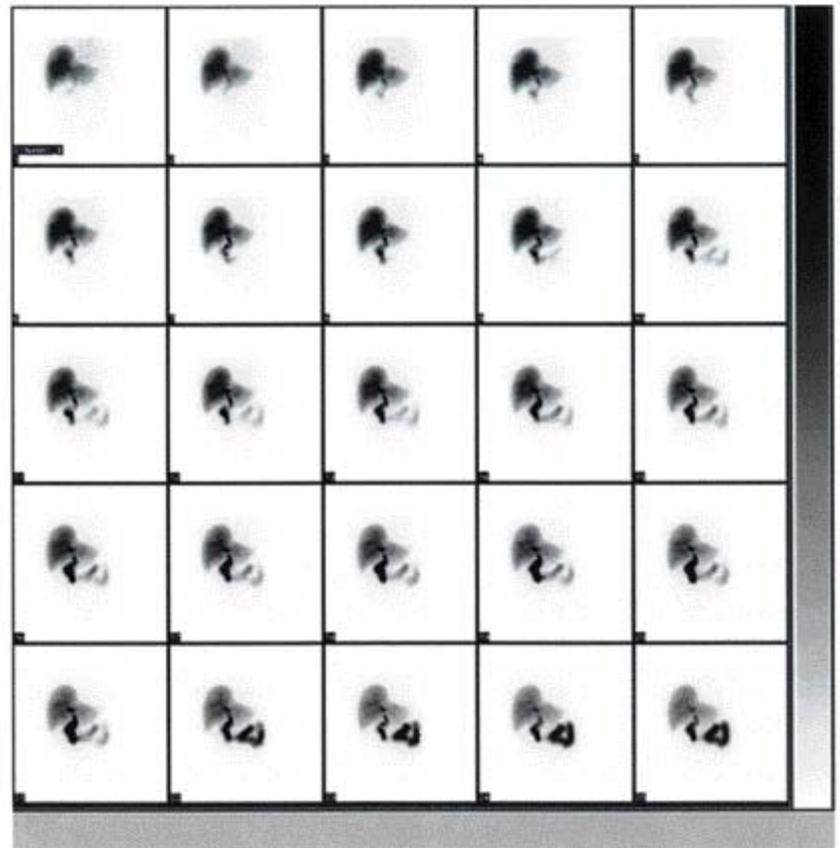
*It is highly likely that the entire thyroid gland will be destroyed with this procedure. Since hormones produced by the thyroid are essential for metabolism, most patients will need to take thyroid pills for the rest of their life following the procedure. There are essentially no other permanent side effects from the procedure.*

## **HIDA**

### **(Gallbladder Scan)**

*A gallbladder scan is a nuclear scanning test that is done to evaluate gallbladder function. It can detect blockage in the tubes (bile ducts) that lead from the liver to the gallbladder and small intestine (duodenum).*

*During a gallbladder scan, a radioactive tracer substance is injected into a vein in the arm. The liver removes the tracer from the bloodstream and adds it to the bile that normally flows through the bile ducts to the gallbladder. The gallbladder then releases the tracer into the beginning of the small intestine. A special camera (gamma) takes pictures of the tracer as it moves through the liver, bile ducts, gallbladder, and small intestine.*



*A gallbladder scan is done to:*

- *Help determine the cause of pain in the upper right side of the abdomen.*
- *Evaluate the function of the gallbladder. A gallbladder ultrasound may be done before a gallbladder scan to help detect structural problems in the gallbladder. If the ultrasound is normal, a gallbladder scan often is done to evaluate gallbladder function.*
- *Help determine the cause of jaundice.*
- *Detect blockage of the tubes (bile ducts) leading from the liver to the gallbladder and small intestine (duodenum).*

### **How To Prepare**

*Before your gallbladder scan, tell your doctor if:*

- *You are or might be pregnant.*
- *You are breast-feeding. Use formula (discard your breast milk) for 1 to 2 days after the scan until the radioactive tracer has been eliminated from your body.*
- *Within the past 4 days, you have had an X-ray test using barium contrast material (such as a barium enema) or have taken a medication (such as Pepto-Bismol) that contains bismuth. Barium and bismuth can interfere with test results.*

*Do not eat or drink for 4 to 12 hours before a gallbladder scan. Your doctor will tell you how long depending on what the test is being done for.*

*You may be asked to sign a consent form before the test. Talk to your doctor about any concerns you have regarding the need for the test, its risks, how it will be done, or what the results will mean.*

### **How It Is Done**

*A gallbladder scan is usually done by a nuclear medicine technologist. The scan pictures are usually interpreted by a radiologist or nuclear medicine specialist.*

*You will need to remove any jewelry that might interfere with the scan. You may need to take off all or most of your clothes, depending on which area is being examined (you may be allowed to keep on your underwear if it does not interfere with the test). You will be given a cloth or paper covering to use during the test.*

*The technologist cleans the site on your arm where the radioactive tracer will be injected. A small amount of the radioactive tracer is then injected.*

*You will lie on your back on a table and a large scanning camera will be positioned closely above your abdomen. After the radioactive tracer is injected, the camera will scan for radiation released by the tracer and produce pictures as the tracer passes through your liver and into your gallbladder and small intestine. The first pictures will be taken immediately after the injection, and then about every 5 to 10 minutes for up to the next 1½ hours. Each scan takes only a few minutes. You need to lie very still during each scan to avoid blurring the pictures. The camera does not produce any radiation, so you are not exposed to any additional radiation while the scan is being done.*

*A substance (cholecystokinin) that stimulates the gallbladder may also be injected into your vein during the scans. The pictures taken after this injection can help determine whether the gallbladder is functioning normally. Computer analysis of the data may be used to evaluate gallbladder function. You may be asked to answer questions about your reaction to the cholecystokinin. Occasionally medication (morphine sulfate) is given to help diagnose inflammation of the gallbladder.*

*Depending upon your results, additional scans may be taken up to a day later. If you need to return for another gallbladder scan, you should not eat any fatty foods before you return.*

*The gallbladder scan takes about 1 to 2 hours.*

### **How It Feels**

*You may feel nothing at all from the needle puncture when the tracer is injected, or you may feel a brief sting or pinch as the needle goes through the skin. Otherwise, a gallbladder scan is usually painless. You may find it difficult to remain still during the scan. Ask for a pillow or blanket to make yourself as comfortable as possible before the scan begins.*

*The test may be uncomfortable if you are having abdominal pain. Try to relax by breathing slowly and deeply.*

*If cholecystokinin is used during the test, it may cause nausea or abdominal pain. The development of these symptoms during the test may indicate a problem with your gallbladder. The technologist may ask you about changes in your pain during the test.*

## Risks

Allergic reactions to the radioactive tracer are rare. Most of the tracer will be eliminated from your body (through your urine or stool) within a day, so be sure to promptly flush the toilet and thoroughly wash your hands with soap and water. The amount of radiation is so small that it is not a risk for people to come in contact with you following the test.

Occasionally, some soreness or swelling may develop at the injection site. These symptoms can usually be relieved by applying moist, warm compresses to your arm.

There is always a slight risk of damage to cells or tissue from being exposed to any radiation, including the low level of radiation released by the radioactive tracer used for this test.

## Results

A gallbladder scan is a special nuclear scanning test that is done to evaluate gallbladder function. The results of a gallbladder scan are available in 2 days.

Gallbladder Scan	
<b>Normal:</b>	<i>The radioactive tracer flows evenly through the liver and then into the gallbladder and the beginning of the small intestine (duodenum).</i>
	<i>The gallbladder is normal in size, shape and location.</i>
<b>Abnormal:</b>	<i>The tracer may not be removed normally from the bloodstream by the liver, indicating possible liver disease.</i>
	<i>The tracer may not reach the gallbladder, indicating inflammation or blockage of the duct by a gallstone.</i>
	<i>The tracer may not reach the beginning of the small intestine (duodenum), indicating blockage of a bile duct by a stone, a tumor, or inflammation of the pancreas.</i>
	<i>Pain occurs when the gallbladder empties the tracer.</i>

## What Affects the Test

Factors that can interfere with your test and the accuracy of the results include:

- *Pregnancy. A gallbladder scan is not usually done during pregnancy because the radiation could damage the developing baby (fetus).*
- *Barium and bismuth. If a gallbladder scan is needed, it should be done before any tests that use barium (such as a (barium enema).*
- *The inability to remain still during the test.*
- *Being allergic to morphine.*

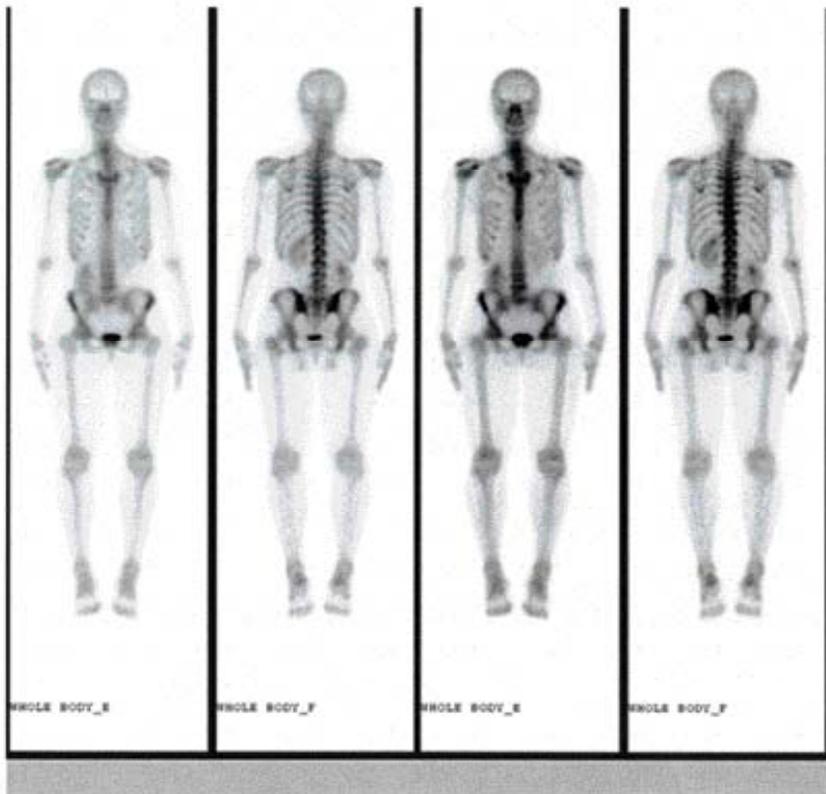
## What To Think About

- *A gallbladder ultrasound test may also be done to detect problems of the gallbladder. The ultrasound test provides more information about the shape and size of the gallbladder than a nuclear scan does. However, the nuclear scan can provide information about how well the gallbladder is functioning and whether the bile ducts are blocked. For more information, see the medical test Abdominal Ultrasound.*
- *The results of a gallbladder scan should be interpreted along with your symptoms and the results of other tests, such as a physical examination and an ultrasound. Abnormal results from a gallbladder scan do not necessarily mean that the gallbladder needs to be removed.*
- *A test called endoscopic retrograde cholangiopancreatogram (ERCP) can be done to detect blockage of the bile duct. For more information, see the medical test Endoscopic Retrograde Cholangiopancreatogram (ERCP).*
- *A magnetic resonance imaging (MRI) method called MR cholangiopancreatogram (MRCP) may also be done to detect blockage of the bile duct.*

## Bone scan

When you think of bones, you may picture dry, brittle structures similar to what you'd find in a museum or what anthropologists find buried in the desert. But the bones inside your body are anything but static — they're alive and active, providing support for your body and serving as your body's warehouse for important minerals. Inside some of your bones is a soft core called bone marrow that manufactures blood cells.

This process of bone growth and renewal is part of your body's metabolism — natural processes that create and use energy. Changes in your bone metabolism can be caused by a number of specific problems. To get a picture of your bone metabolism, your doctor may use a procedure called a bone scan.



## What is a bone scan?

Your doctor may order a bone scan to help diagnose subtle or hidden bone fractures that may not show up on a routine X-ray, such as a stress fracture. Bone scans can also help detect:

- Bone cancer
- Bone infections
- Arthritis
- Causes of unexplained bone pain

A bone scan falls under the category of nuclear medicine, which means that it uses tiny amounts of radioactive materials called tracers (radionuclides). These tracers accumulate in certain organs and tissues, such as bones. Once introduced into the body, tracers emit gamma waves of radiation, which are detected by a special camera. This camera produces images that are interpreted by radiologists or nuclear medicine specialists.

In a sense, a nuclear procedure such as a bone scan is the opposite of a standard X-ray examination. An X-ray passes radiation into or through your body to create an image on film placed on the other side of your body. In a nuclear scan, the source of radiation is inside your body and travels to the surface, where a camera detects it.

## When is a bone scan ordered?

Your doctor may order a bone scan to determine whether you have any bone abnormalities that may signify one of the following disorders:

- Fractures
- Arthritis
- Paget's disease of bone
- Bone tumors
- Infection of the bone (osteomyelitis)

- *Osteomalacia or rickets*
- *Fibrous dysplasia*
- *Avascular necrosis*
- *Unexplained pain*

*Your doctor may order a bone scan to determine whether cancer, such as prostate, lung or breast cancer, has spread (metastasized) to the bone.*

### **How do you prepare?**

*No special preparation is required on your part before a bone scan, though you may be asked to remove jewelry or other metal objects. You can eat or drink anything you like before the test.*

*As with most tests, tell your doctor if you're pregnant or think you might be pregnant. Bone scans aren't performed on pregnant women because of concerns about radiation exposure to the fetus.*

### **How is a bone scan done?**

*A bone scan can be divided into two basic parts:*

- **The injection.** *You will receive an injection of tracers into a vein in your arm. You'll then wait about two to four hours to allow the tracers to circulate and be absorbed by your bones. You may be allowed to leave the health care facility during this time. Your doctor will ask you to drink several glasses of water so you'll urinate frequently to remove unabsorbed radioactive material from your system.*
- **The scan.** *During the scan, you'll be asked to lie very still on a table while a machine with an arm-like device supporting the gamma camera passes over your body to record the pattern of tracer absorption by your bones. This is painless. A scan of your entire skeleton takes about 30 minutes. Scanning a limited area of your body takes less time.*

*In some cases, your doctor might order a three-phase bone scan, which includes a series of images taken at different times. A number of images are taken as the tracer is injected, then again shortly after the injection and two to four hours later.*

*For certain conditions your doctor might order a single photon emission computerized tomography (SPECT) scan. This can help analyze conditions that are especially deep in your bone or in places that are difficult to see. A SPECT scan takes about 45 minutes to an hour.*

### **After the test**

*Once inside your body, the tracers don't remain active for long. The radioactivity disappears within one to three days.*

*You should feel no side effects after the procedure, and no aftercare is necessary. If you're breast-feeding, your doctor might ask you to stop for 24 hours after the tracer injection.*

### **Results**

*The radiologist looks for evidence of abnormal bone metabolism on the scans. These show up as darker "hot spots" and lighter "cold spots" where the tracers have or haven't accumulated.*

*Although a bone scan is very sensitive to abnormalities in bone metabolism, it's less helpful in determining the cause of the abnormality, such as a fracture, infection or bone tumor.*

*Other tests are often performed to help establish the diagnosis. In order to rule out bone cancer, for instance, your doctor may need further imaging studies or a biopsy, which is a sample of bone tissue that's removed for examination.*

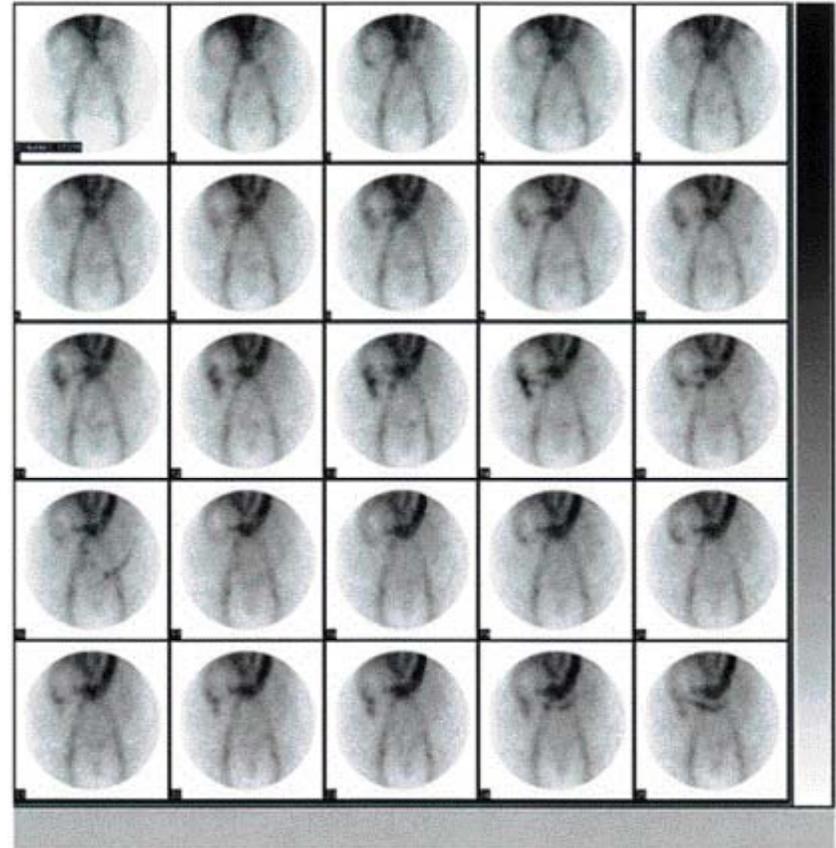
### **Pros and cons**

*A bone scan's sensitivity to variation in bone metabolism and its ability to scan the entire skeleton make it very helpful in diagnosing a wide range of bone disorders. The test poses no greater risk than conventional X-ray procedures. The tracers used in a bone scan produce very little radiation.*

*You might find the injection and the need to lie still during the scanning procedure unpleasant. Your risk of an allergic reaction to the tracers is rare.*

## **Gastric Intestinal Bleed Scan**

*A gastric intestinal bleed scan (GI scan) is a nuclear medicine exam using special radioactive material that allows doctors to locate the site of the GI bleed.*



### **What is a GI Bleed scan?**

*A gastric intestinal bleed scan (GI bleed scan) is a nuclear medicine exam using a radioactive tracer of your blood that allows doctors to locate where the bleeding is from in the stomach or intestine. It is a form of radiology, because radiation is used to*

*capture pictures of the human body.*

### **How does the scan work?**

*A small sample of your blood will be made radioactive. It will then be injected back into you. Your radioactive blood will give off gamma rays. The gamma camera detects the rays and then produces pictures and locates the site of the bleed.*

### **How should I prepare for the scan?**

- *No preparation is needed.*
- *Tell the technologist if you have a heparin allergy.*
- *Please tell the doctor or technologist if there is a chance you may be pregnant.*

### **How is the scan performed?**

1. *The technologist will draw blood through an intravenous (IV) line and then make your red blood cells radioactive. The technologist will inject your blood with tracer in your IV line.*
2. *The gamma camera detects the tracer. A computer will then produce pictures of the abdomen based on the detected gamma rays.*
3. *The imaging involves lying flat on your back while the camera takes pictures over your abdomen.*
4. *The technologist will help make you comfortable. The imaging will take a minimum of 1 hour, and possibly 2 hours. You must not move during the time the camera is taking pictures. If you move, the pictures will be blurry and may have to be repeated.*

### **What will I feel during the scan?**

- *Lying still on the exam table may be hard for some patients.*
- *Some minor discomfort during a nuclear medicine procedure may arise from the IVs.*
- *Most of the radioactivity passes out of your body in urine or stool. The rest simply goes away over time.*

### **Who interprets the results and how do I get them?**

*When the test is over, the nuclear medicine doctor will review your images, prepare a written report, and discuss the results with your doctor. Your doctor will then talk with you about the results and discuss your treatment options.*

## **WHITE BLOOD CELL IMAGING**

### **Alternative Names**

*Leukocyte scan*

### **Definition**

*A WBC scan is a nuclear scan in which a radioactive material is attached to a sample of white blood cells. It is done to locate areas of infection or inflammation.*

### **How the Test is Performed**

*Blood will be taken from one of your veins. White blood cells are separated from the rest of the blood sample and then mixed with a small amount of a radioactive material radioisotope called indium-111. The cells with the radioactive material are considered "tagged."*

*About 2 or 3 hours later, the tagged white blood cells are returned to your body through injection into a vein. The tagged cells gather*

*in areas of inflammation or infection.*

*Approximately 6 to 24 hours later, your body is scanned. You lie on a table. The scanner looks like an x-ray machine. It detects the radiation given off by the radioactive white blood cells. A computer converts the detected radiation into an image that can be viewed on a screen or recorded on film.*

*The scan takes about 1 or 2 hours. The scanner is usually located in a hospital, but often the test can be performed on an outpatient basis.*

*After the test is completed, no recovery time or special precautions are necessary. You typically may resume a normal diet, activity, and medications.*

### **How to Prepare for the Test**

*There is usually no need for fasting, special diets, or preliminary medications. You must sign a consent form. You will wear a hospital gown or be allowed to wear loose fitting clothing without metal fasteners. Remove jewelry, dentures, or metal before the scan.*

*The health care provider will occasionally request that antibiotics be stopped before this test.*

### **How the Test Will Feel**

*There is a sharp prick from the needle during blood sampling and again when the blood is returned to you. The scan itself is painless, although the table that you are asked to lie on may be hard or cold. You do not feel the radioactive material.*

### **Why the Test is Performed**

*WBC scan is most often done when your doctor suspects a hidden infection. It is particularly useful for suspected infection or inflammation within the abdomen.*

*This test may be recommended if you have suspected pyelonephritis, abscess, osteomyelitis, or unexplained fever, particularly after surgery.*

### **Normal Results**

*A normal result means there are no accumulations of tagged cells (except for a certain amount in the liver and spleen, which normally accumulate white blood cells).*

### **What Abnormal Results Mean**

*Abnormal results usually suggest an active inflammation or infection, such as a liver abscess or abdominal abscess.*

### **Risks**

*There is a very slight exposure to radiation from the radioisotope. The spleen normally receives the highest dose of radiation because white blood cells normally accumulate in the spleen. The radiation from these materials is very slight, and the materials decompose (become no longer radioactive) in a very short time. Virtually all radioactivity is gone within 1 or 2 days. There are no documented cases of injury from exposure to radioisotopes. The scanner only detects radiation -- it does not emit any radiation.*

*However, because of the slight radiation exposure, most nuclear scans (including WBC scan) are not recommended for women who are pregnant or breastfeeding.*

*Veins and arteries vary in size from one patient to another and from one side of the body to the other. Obtaining a blood sample from some people may be more difficult than from others.*

*Other risks associated with having blood drawn are slight but may include:*

- *Excessive bleeding*
- *Fainting or feeling light-headed*
- *Hematoma (blood accumulating under the skin)*

- Infection (a slight risk any time the skin is broken)

Extremely rarely, a person may experience an allergic reaction to the radioisotope. This may include anaphylaxis if the person is extremely sensitive to the substance.

### Considerations

The long delay before the person can be scanned may be undesirable for critically ill people.

Other tests (such as CT scan or ultrasound) may be required to confirm the presence of inflammation or infection indicated by an abnormal WBC scan.

False-negative results can theoretically occur as a consequence of antibiotic usage or *chronic* infection. Infection in the liver or spleen can be missed because of normal WBC accumulation in these organs.

False-positive results can occur from many causes, including (but not limited to) bleeding, the presence of tubes or catheters in the body, and skin wounds (such as surgical incisions). WBC accumulations in the lungs does not necessarily indicate an infection in the lungs.

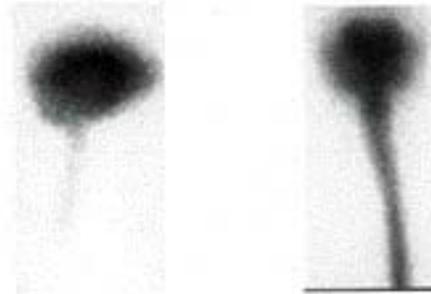
## CISTERNOGRAPHY

### Alternative Names

Intrathecal scan; Spinal cord scan; CSF flow scan; Cisternogram

### Definition

A radionuclide cisternogram is a nuclear scan test used to diagnose spinal fluid circulation problems.



### How the Test is Performed

A lumbar puncture (spinal tap) is done first. Small amounts of radioactive material, called a radioisotope, are injected into the fluid in the lower spine.

You will be scanned 4 - 6 hours after receiving this injection. A special camera creates images that show how the radioactive materials travel with the cerebrospinal fluid through the spine and if the fluid leaks outside the spine.

You will be scanned again 24 hours after injection, and possibly at 48 and 72 hours after injection.

### How to Prepare for the Test

No preparation is usually necessary. However, if you are very anxious or agitated, sedation may be necessary. You must sign a consent form. You will wear a hospital gown to make the spine more accessible. Remove jewelry or metallic objects before the scan.

## **How the Test Will Feel**

*During lumbar puncture, the lower back over the spine is numbed with an anesthetic. However, many people find lumbar puncture somewhat uncomfortable, usually because of the pressure on the spine during insertion of the needle.*

*The scan is painless, although the table may be cold or hard. No discomfort is produced by the radioisotope or the scanner.*

## **Why the Test is Performed**

*The test is performed to detect problems with spinal fluid circulation and spinal fluid leaks.*

## **Normal Results**

*A normal value indicates normal circulation of CSF through all parts of the brain and spinal cord.*

## **What Abnormal Results Mean**

*An abnormal study indicates disorders of CSF circulation, including: Hydrocephalus*

- *Hydrocephalus*
- *CSF leak*
- *Normal pressure hydrocephalus (NPH)*
- *Whether or not a CSF shunt is open or blocked*

## **Risks**

*Risks associated with a lumbar puncture include pain at the injection site, bleeding, and infection. There is also a very rare chance of nerve damage.*

*The amount of radiation used during the nuclear scan is very small, and virtually all of the radiation is gone within a few days.*

*There have been no documented cases of injury or damage caused by the radioisotope used with this scan. However, as with any radiation exposure, caution is advised if you are pregnant or breastfeeding.*

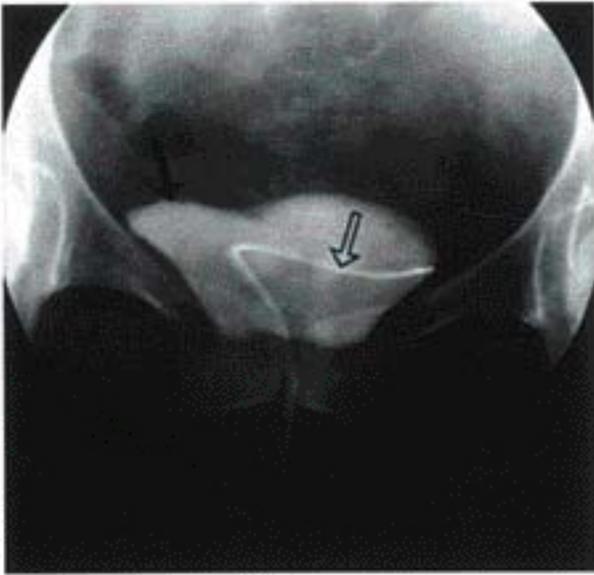
*In extremely rare cases, a person will develop an allergic reaction to the radioisotope used during the scan. This may include a serious anaphylactic reaction.*

## **Considerations**

*You should lie flat after the lumbar puncture (to help prevent headache from the lumbar puncture). No other special care is usually necessary.*

## Cystogram

A cystogram is an examination of the urinary bladder, which is located in the lower pelvic area. A cystogram can show the bladder's position and shape, and the exam often is used to diagnose a condition called reflux. Reflux occurs when urine in the bladder moves back up the ureters, the tubes that transport urine from the kidneys to the bladder. This condition can cause repeated urinary tract infections. A cystogram may be performed after a patient has experienced a pelvic injury to ensure that the bladder has not torn. Cystograms also are used to detect polyps or tumors in the bladder.



*A cystogram showing the bladder (solid arrow) filling with a contrast agent. The catheter used to fill the bladder also is visible (outlined arrow).*

### Patient Preparation

Before your examination, a radiographer will explain the procedure to you and answer any questions you might have. A radiographer, also known as a radiologic technologist, is a skilled medical professional who has specialized education in the areas of radiation protection, patient care and radiographic positioning and procedures.

If you are a woman of childbearing age, the radiographer will ask the date of your last menstrual period and if there is any possibility you are pregnant. Next, the radiographer will ask if you have any allergies. It is important to list all allergies to food and medicine, as well as to let the radiographer know if you have a history of hay fever or asthma. Some allergies may indicate a possible reaction to the contrast agent that will be used during the examination.

You will be asked to put on a hospital gown and then the radiographer will direct you to the restroom and ask you to completely empty your bladder.

### During the Examination

You will be positioned on your back on the x-ray table, with your knees flexed. Your pubic area will be washed, and then the radiographer or a radiology nurse will gently insert a small, flexible catheter into your urethra, the duct from which you urinate. Skin tape may be used to hold the catheter to your inner thigh.

Next, a nurse will slowly fill your bladder with a radioactive contrast agent. The contrast agent is a substance that helps make organs easier to see on radiographs and is administered through the catheter. You will feel pressure and fullness in your bladder and will have an urge to urinate.

After your bladder is full, the images will be taken. You will be asked to lie on your side or to turn slightly from side to side while the technologist watches your bladder on the TV screen. The radiographer also may take a few additional images.

Following this portion of the exam, the catheter will be removed, and you will be allowed to use the restroom. In addition, the contrast agent that you expel is radioactive, clear and odorless, so it will not be visible to you. After you return to the room, an additional image will be taken. This final radiograph will show whether any contrast agent stays in your bladder following urination. Any remaining contrast will be expelled the next time you urinate.

### **Voiding Cystourethrogram**

Voiding cystourethrograms follow the same routine as cystograms with one difference. Toward the end of the examination, when the urinary catheter is removed, you will be asked to urinate into a special urinal. Radiographs will be taken while you urinate. These images will show the size and shape of the bladder when it is under stress caused by urination.

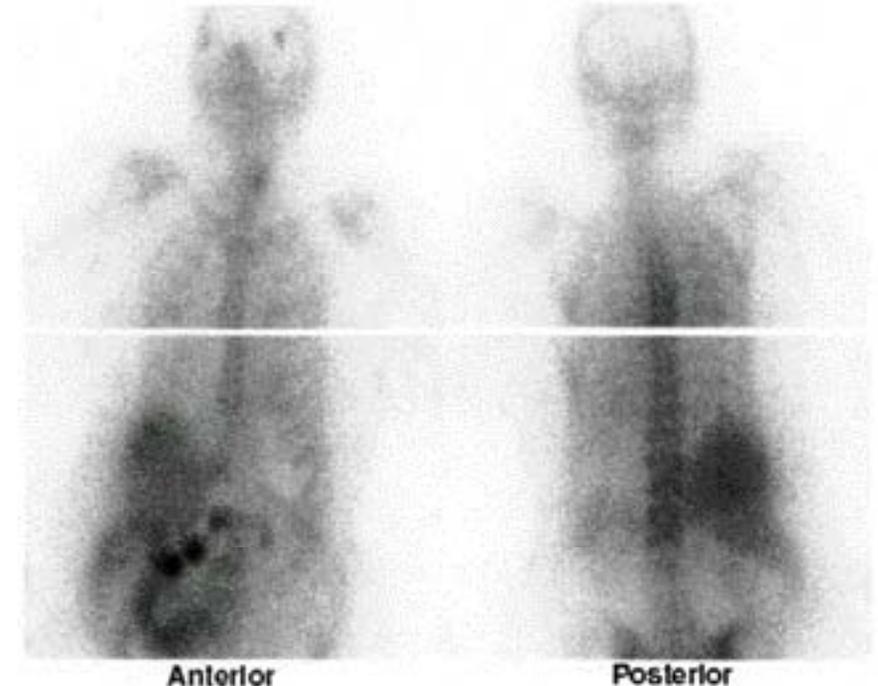
### **Post-examination Information**

Your radiographs will be reviewed by the radiologist, and your personal physician will receive a report of the findings. Your physician then will advise you of the results and discuss what further procedures, if any, are needed.

## **Gallium Scan**

A gallium scan is a nuclear medicine test that uses a special camera to take pictures of specific tissues in the body after a radioactive tracer (radionuclide or radioisotope) makes them visible. Each type of tissue that may be scanned (including bones, organs, glands, and blood vessels) uses a different radioactive compound as a tracer. The radioactivity of different tracers decreases over a period of usually hours, days, or weeks. The tracer remains in the body temporarily before it is eliminated as waste, usually in the urine or stool (feces).

During a gallium scan, the tracer (radioactive gallium citrate) is injected into a vein in the arm. It travels through the bloodstream and into the body's tissues, primarily the bones, liver, intestine, and areas of tissue where inflammation or a buildup of white blood cells (WBCs) is present. It usually takes the tracer a few days to accumulate in these areas, so in most cases a scan is done at 2 days and repeated at 3 days after the tracer is injected. Areas where the tracer accumulates in higher-than-normal amounts show up as bright or "hot" spots in the pictures. The problem areas may be caused by infection, certain inflammatory diseases, or a tumor.



## Why It Is Done

A gallium scan is done to:

- Detect the source of an infection that is causing a fever (called a fever of unknown origin).
- Detect an abscess or certain infections, especially in the bones.
- Monitor the response to antibiotic treatment.
- Diagnose inflammatory conditions such as pulmonary fibrosis or sarcoidosis.
- Detect certain types of cancer (such as lymphoma). A gallium scan also may be done to determine whether cancer has spread (metastasized) to other areas of the body, or to monitor the effectiveness of cancer treatment.

## How To Prepare

Before the gallium scan, tell your doctor if:

- You are or might be pregnant.
- You are breast-feeding. If you will no longer be breast-feeding after the test, you will be asked to stop breast-feeding 2 weeks before the test so that the radioactive tracer will not accumulate in your breast tissue. If you will continue to breast-feed after the test, it is recommended that you not use your breast milk for 4 weeks after a gallium scan, since the tracer can be passed to your baby. Some doctors may recommend that you stop breast-feeding completely after this scan.
- Within the past 4 days, you have had an X-ray test using barium contrast material (such as a barium enema) or have taken a medicine (such as Pepto-Bismol) that contains bismuth. Barium and bismuth can interfere with test results.

Gallium accumulates in the large intestine (colon) before being eliminated in the stool. You may need to take a laxative the night before the scan and have an enema 1 to 2 hours before the scan to prevent the gallium in your colon from interfering with pictures of the area being studied.

Talk to your doctor about any concerns you have regarding the need for the test, its risks, how it will be done, or what the results will indicate

Nuclear Medicine 30

## How It Is Done

A gallium scan is usually done by a nuclear medicine technologist. The scan pictures are usually interpreted by a radiologist or nuclear medicine specialist.

The technologist cleans the site on your arm where the radioactive tracer will be injected. A small amount of the radioactive tracer is then injected. You will need to return between 24 and 96 hours later for the diagnostic scans. Gallium scans are usually done at 48 hours and repeated at 72 hours after the tracer is injected.

When you come in for the scan, you will need to remove any jewelry that might interfere with the scan. You may need to take off all or most of your clothes, depending on which area is being examined (you may be allowed to keep on your underwear if it does not interfere with the test). You will be given a cloth or paper covering to use during the test.

You will lie on your back on a table, and a large scanning camera will be positioned closely above you. After the radioactive tracer is injected, the camera will scan for radiation released by the tracer and produce pictures of the tracer in your tissues. The camera may move slowly above and around your body. The camera does not produce any radiation, so you are not exposed to any additional radiation while the scan is being done.

You may be asked to move into different positions so the area of interest can be viewed from other angles. You need to lie very still during each scan to avoid blurring the pictures. You may be asked to hold your breath briefly during some of the scans.

Each scan may take about 60 to 90 minutes.

## How It Feels

You may feel nothing at all from the needle puncture when the tracer is injected, or you may feel a brief sting or pinch as the needle goes through the skin. Otherwise, a gallium scan is usually painless. You may find it difficult to remain still during the scan. Ask for a pillow or blanket to make yourself as comfortable as possible before the scan begins.

## Risks

There is always a slight risk of damage to cells or tissue from being exposed to any radiation, including the low level of radiation released by the radioactive tracer used for this test.

Allergic reactions to the radioactive tracer are rare. Most of the tracer will be eliminated from your body (through your urine or stool) within 4 days. The amount of radiation is so small that it is not a risk for people to come in contact with you following the test.

Occasionally, some soreness or swelling may develop at the injection site. These symptoms can usually be relieved by applying moist, warm compresses to your arm.

## Results

A gallium scan is a nuclear medicine test that uses a special camera to take pictures of certain tissues in the body after a radioactive tracer (radionuclide or radioisotope) makes them visible. The results of a gallium scan are usually available within 2 days after the scans are completed.

Gallium scan	
<b>Normal:</b>	The collection and activity of gallium in the bones, liver, spleen and large intestine (colon) is normal. No areas of unusual gallium accumulation are seen.
<b>Abnormal:</b>	An abnormally high gallium accumulation (hot spot) is present in one or more areas of the body, possibly indicating inflammation, infection or a tumor.

## What Affects the Test

Factors that can interfere with your test and the accuracy of the results include:

- **Pregnancy.** A gallium scan is not usually done during pregnancy because the radiation could damage the developing baby (fetus).
- **Barium and bismuth.** If a gallium scan is needed, it should be done before any tests that use barium (such as a barium enema).

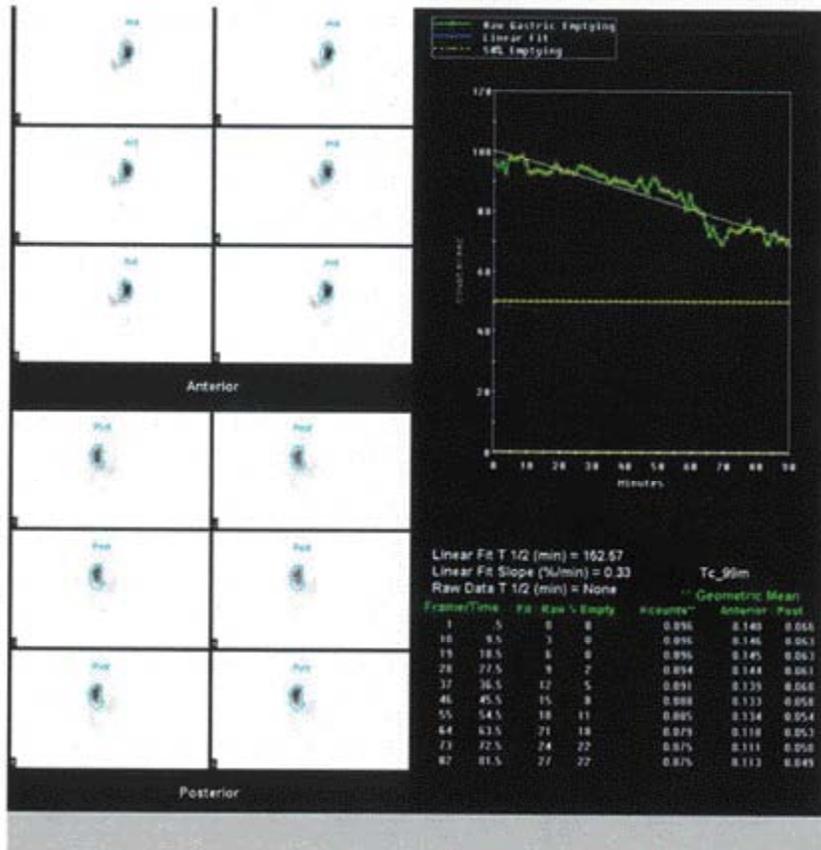
- **The inability to remain still during the test.**

## What To Think About

- A gallium scan is used for specific types of cancers, mainly of the lymph nodes, bones, or bone marrow. A normal scan does not exclude the possibility of cancer, because some types of cancer do not show up on a gallium scan. A gallium scan also cannot determine whether a tumor is cancerous (malignant) or noncancerous (benign).
- The results of a gallium scan should be interpreted along with the results of other tests, such as a physical examination, blood tests, and X-rays. In many cases, results obtained from a magnetic resonance imaging (MRI) or positron emission tomography (PET) may be as accurate as the results obtained from a gallium scan. For more information, see the medical tests **Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET)**.
- If other nuclear scanning tests need to be done, these tests should be scheduled before a gallium scan because the gallium tracer stays in the body longer than other tracer compounds.

# GASTRIC EMPTYING

A gastric emptying scan (GES) is a nuclear medicine exam using a radioactive material in a meal that allows doctors to identify abnormalities related to emptying of the stomach.



## What is a gastric emptying scan?

A gastric emptying scan (GES) is a nuclear medicine exam using a radioactive material in a meal that allows doctors to identify abnormalities related to emptying of the stomach. Diseases that involve changes in the way the stomach contracts (motility disorders) are best diagnosed by this test. It is a form of radiology, Nuclear Medicine 34

because radiation is used to capture pictures of the human body.

## How does the scan work?

Pictures are taken over time of the movement of a radioactive meal through your stomach. The gamma camera detects the gamma rays emitting from the radioactive meal and then produces pictures and measurements of the stomach.

## How should I prepare for the scan?

- The only preparation involved is to fast 8 hours before the test.
- If you are diabetic, drink a 5-ounce glass of orange juice about 2 hours before your exam.
- The exam should not be performed on pregnant women, but is otherwise quite safe.
- Since oatmeal is usually used to hold the radioactive material, patients should notify their doctor if they are allergic to oatmeal. If needed, other foods can be used.

## How is the scan performed?

1. You will be given a bowl of oatmeal that has been injected with a small dose of radioactive material. You will be asked to eat the oatmeal and drink water within 5 minutes. The oatmeal will not taste any different than a non-radioactive bowl of oatmeal.
2. After eating this meal, pictures of your stomach will be taken. The imaging involves lying flat on your back while the camera takes pictures of your stomach for 90 minutes.

*The technologist will help make you comfortable. You must not move during the time the camera is taking pictures. If you move, the pictures will be blurry and the exam may have to be repeated.*

- The radioactive meal emits gamma rays. The gamma camera detects the rays. A computer will then produce pictures of the stomach based on the detected gamma rays.*

### **What will I feel during the scan?**

- Lying still on the exam table may be hard for some patients.*

### **Who interprets the results and how do I get them?**

*When the test is over, the nuclear medicine doctor will review your images, prepare a written report, and discuss the results with your doctor. Your doctor will then talk with you about the results and discuss your treatment options.*

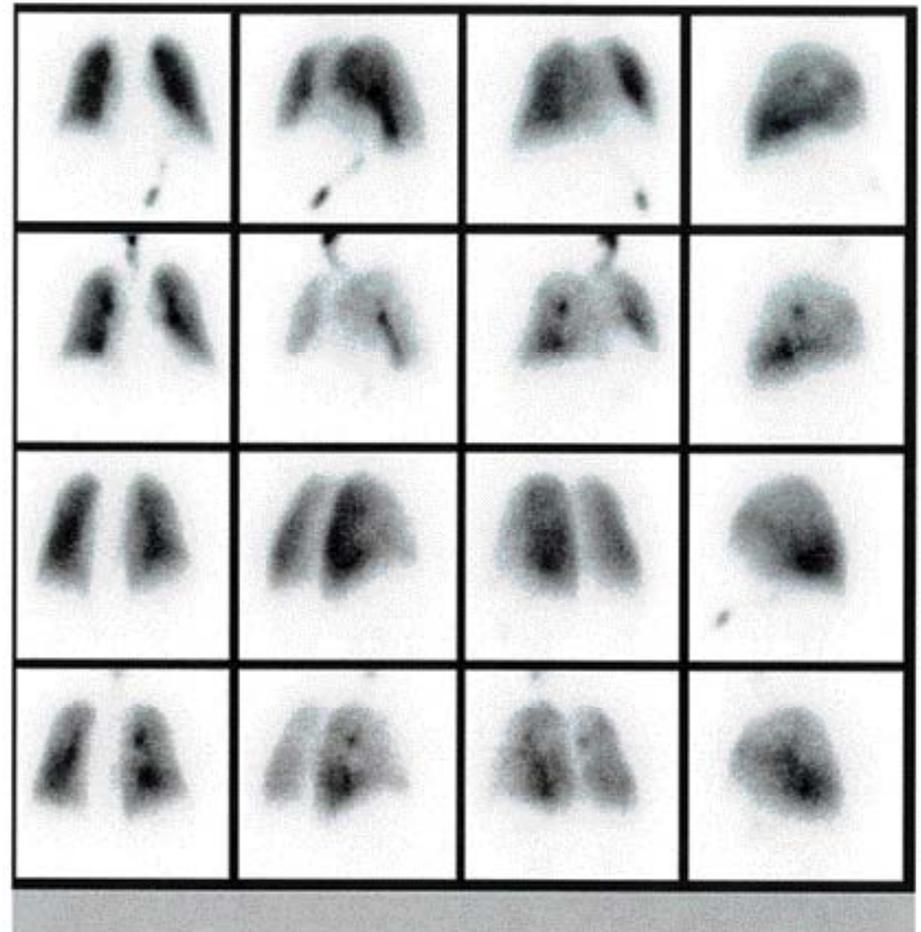
## **LUNG SCAN**

### **Alternative Names**

*V/Q scan; Ventilation/perfusion scan; Lung ventilation/perfusion scan*

### **Definition**

*A pulmonary ventilation/perfusion scan is a pair of **nuclear scan** tests. These tests use inhaled and injected radioactive material (radioisotopes) to measure breathing (ventilation) and circulation (perfusion) in all areas of the lungs.*



## **How the Test is Performed**

*A pulmonary ventilation/perfusion scan is actually two tests. These tests may be performed separately or together.*

*During the perfusion scan, a health care provider injects radioactive albumin into the patient's vein. The patient is immediately placed on a movable table that is under the arm of a scanner. The machine scans the patient's lungs as blood flows through them to detect the location of the radioactive particles.*

*The ventilation scan is performed by scanning the lungs while the person inhales radioactive gas. With a mask over the nose and mouth, the patient breathes the gas while sitting or lying on the table beneath the scanner arm.*

## **How to Prepare for the Test**

*You do not need to fast, eat a special diet, or take any medications before the test.*

*A chest x-ray is usually performed prior to or following a ventilation and perfusion scan.*

*You will wear a hospital gown or comfortable clothing that does not have metal fasteners.*

## **How the Test Will Feel**

*The table may feel hard or cold. You may feel a sharp prick while the material is injected into the vein for the perfusion portion of the scan. The mask used during the ventilation scan may give you a claustrophobic feeling. You must lie still during scanning.*

*The radioisotope injection usually does not cause discomfort.*

## **Why the Test is Performed**

*The ventilation scan is used to see how well air reaches all parts of the lungs. The perfusion scan measures the blood supply through the lungs.*

*A ventilation and perfusion scan is most often performed to detect a pulmonary embolus. It is also used to evaluate lung function in people with advanced pulmonary disease, such as COPD, and to detect abnormal circulation (shunts) in the pulmonary blood vessels.*

## **Normal Results**

*The health care provider should take a ventilation and perfusion scan and then evaluate it with a chest x-ray. All parts of both lungs should take up the radioisotope uniformly.*

## **What Abnormal Results Mean**

*A decreased uptake of radioisotope during a perfusion scan indicates a problem with blood flow, including occlusion of the pulmonary arteries. A localized decrease in perfusion scan uptake (particularly when the ventilation scan is normal) may indicate pulmonary embolus. Larger areas of decreased perfusion scan uptake may indicate a condition such as pneumonitis.*

*A decreased uptake of radioisotope during a ventilation scan may indicate reduced breathing and ventilation ability or airway obstruction. A decreased ventilation uptake (plus x-ray evidence of consolidation) may indicate pneumonia. Larger areas of poor uptake may indicate damage from chronic smoking or COPD.*

## Risks

*Risks are about the same as for x-rays (radiation) and needle pricks.*

*No radiation is emitted from the scanner. Instead, it detects radiation and converts it to a visible image. There is a small exposure to radiation from the radioisotope. The radioisotopes used during scans are short-lived, with almost all radiation leaving the body in a few days. However, as with any radiation exposure, caution is advised for pregnant or breast-feeding women.*

*There is a slight risk for infection or bleeding at the site of the needle insertion. The risk with perfusion scan is the same as with inserting an intravenous needle for any other purpose.*

*In rare cases, a person may develop an allergy to the radioisotope, which may include a serious anaphylactic reaction.*

## Considerations

*A pulmonary ventilation and perfusion scan may be a lower-risk alternative to pulmonary angiography for evaluating disorders of the lung blood supply.*

*This test may not provide an absolute diagnosis, particularly in people with underlying lung disease. Other tests may be necessary to confirm or rule out the findings of a pulmonary ventilation and perfusion scan.*

# Meckel's Diverticulum Scan

## Synonyms

*Ectopic Gastric Mucosa Scan; Meckel's Scan; Meckel's Scintigraphy*

## Procedure Commonly Includes

*The patient receives an intravenous injection of technetium-99m (<sup>99m</sup>Tc) pertechnetate which is quickly secreted by gastric mucosa cells including sites of ectopic tissue, the Meckel's diverticulum. Sequential images of the abdomen are then acquired. The abnormality usually visualizes early, but delayed images are sometimes necessary.*

## Indications

*The procedure is useful in detecting the presence and location of a Meckel's diverticulum, a collection of functioning ectopic gastric mucosa usually located in the ileum and in the right lower quadrant of the abdomen. The abnormality usually occurs in young children and 50% of cases that bleed symptomatically will present before the age of 2 years.*

## Patient Preparation

*Patient should have all RIA blood work performed, or at least drawn, prior to injection of any radioactive material. Patient must be fasting at least 4 hours before scan.*

## Special Instructions

*Requisition must state the current patient diagnosis in order to select the most appropriate radiopharmaceutical and/or imaging technique. DURATION OF PROCEDURE: 30 minutes to 1 hour although additional delayed images may be required.*

**RADIOPHARMACEUTICAL:** <sup>99m</sup>Tc pertechnetate

## Causes for Rejection

*Residual barium in GI tract from recent x-rays, other recent Nuclear Medicine procedure may interfere. If uncertain, call the Nuclear Medicine Department.*

## Turnaround Time

*A written report will be sent to the patient's chart and/or to the referring physician.*

## Normal Findings

*Lack of any focal secreted activity in the abdomen. Patients are often placed in a left lateral decubitus position to slow transit of normal secreted activity from the stomach into the small bowel.*

## Limitations

*A Meckel's diverticulum without functioning gastric mucosa will not visualize. However, those lacking mucosa are also unlikely to bleed. Some false-positives may result from nondiverticular bleeding, intussusception, duplication cysts, or inflammatory bowel disease.*

## Multigated Acquisition Scan (MUGA scan, nuclear ventriculogram, radionuclide scan)

### Definition:

*A nuclear scan that evaluates the pumping function of the ventricles.*

**Your doctor uses the MUGA to determine the heart's pumping function.**

*To prepare, wear comfortable clothes that can be easily removed. You may be asked to wear a hospital gown during the MUGA scan.*

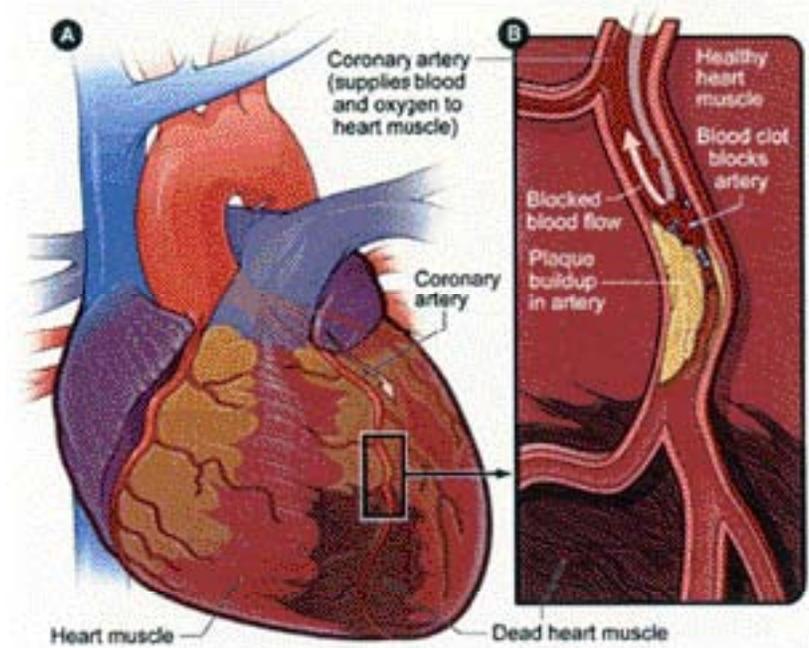


### What to expect:

- *During a MUGA scan, a technician will attach 10 electrodes with adhesive pads to the skin of your chest. Men may have chest hair shaved to allow a better connection. The electrodes are attached to an electrocardiograph monitor (ECG), which charts your heart's electrical activity during the test.*
- *An intravenous (IV) line will be inserted into a vein in your arm. The technician will perform a resting ECG, measure your resting heart rate and take your blood pressure.*
- *The technician will ask you to lie on the exam table under a camera. A small amount of blood is withdrawn and mixed with a radioactive tracer. The radioactive tracer binds to the red blood cells, and the mixture is re-injected into the IV. The tracer stays in the bloodstream for several hours and does not enter your tissue cells.*

- *A large camera, located above the table, is focused on the heart and analyzes the amount of radio-labeled red blood cells pumped out of the heart with each heartbeat. This test calculates the amount of blood pumped out of the heart with each heartbeat, called the ejection fraction.*

*The MUGA scan takes about one to two hours to perform.*



## Cardiolite Stress Test

*A stress test can be used to test for heart disease. Stress tests are tests performed by a doctor and/or trained technician to determine the amount of stress that your heart can manage before developing either an abnormal rhythm or evidence of ischemia (not enough blood flow to the heart muscle). The most commonly performed stress test is the exercise stress test.*

### What Is an Exercise Stress Test?

*The exercise stress test -- also called a stress test, exercise electrocardiogram, treadmill test, graded exercise test or stress ECG -- is a test used to provide information about how the heart responds to exertion. It usually involves walking on a treadmill or pedaling a stationary bike at increasing levels of difficulty, while your electrocardiogram, heart rate and blood pressure are monitored.*

## Why Do I Need a Stress Test?

Your doctor uses the stress test to:

- Determine if there is adequate blood flow to your heart during increasing levels of activity.
- Evaluate the effectiveness of your heart medications to control angina and ischemia.
- Determine the likelihood of having coronary heart disease and the need for further evaluation.
- Check the effectiveness of procedures done to improve blood flow within the heart vessels in people with coronary heart disease.
- Identify abnormal heart rhythms.
- Help you develop a safe exercise program.

## What Types of Stress Tests Are There?

There are many different types of stress tests, including:

- **Dobutamine or Adenosine Stress Test:** This test is used in people who are unable to exercise. A drug is given to make the heart respond as if the person were exercising. This way the doctor can still determine how the heart responds to stress, but no exercise is required.
- **Stress echocardiogram:** An echocardiogram (often called “echo”) is a graphic outline of the heart’s movement. A stress echo can accurately visualize the motion of the heart’s walls and pumping action when the heart is stressed; it may reveal a lack of blood flow that isn’t always apparent on other heart tests.
- **Nuclear stress test:** This test helps to determine which parts of the heart are healthy and function normally and which are not. A very small and harmless amount of radioactive substance is injected into the patient. Then the doctor uses a special camera to identify the rays emitted from the substance within the body; this produces clear pictures of the heart tissue on a monitor. These pictures are done both at rest and after exercise. Using this technique, a less than normal amount of thallium will be seen in those areas of the heart that have a decreased blood supply.

Preparation for these types of stress test will vary from preparation for the exercise stress test. Ask your doctor about any specific instructions.

## How Should I Prepare for the Exercise Stress Test?

Before your stress test:

- Do not eat or drink anything except water for four hours before the test.
- Do not drink or eat foods containing caffeine for 12 hours before the test. Caffeine will interfere with the results of your test.
- Do not take the following heart medications on the day of your test unless your doctor tells you otherwise, or if the medication is needed to treat chest discomfort the day of the test: Isosorbide dinitrate (for example, Isordil, Dilatrate SR); Isosorbide mononitrate (for example, ISMO, Imdur, Monoket); Nitroglycerin (for example, Deponit, Nitrostat, Nitro-bid). Your doctor may also ask you to stop taking other heart medications on the day of your test. If you have any questions about your medications, ask your doctor. Do not discontinue any medication without first talking with your doctor.
- If you use an inhaler for your breathing, please bring it to the test.

## What If I have Diabetes?

If you have diabetes:

- If you take insulin to control your blood sugar, ask your doctor what amount of your medication you should take the day of the test. Often, you will take only half of your usual morning dose and eat a light meal 4 hours before the test.
- If you take pills to control your blood sugar, do not take your medication until after the test is complete.
- Do not take your diabetes medication and skip a meal before the test.

- *If you own a glucose monitor, bring it with you to check your blood sugar levels before and after your exercise stress test. If you think that your blood sugar is low, tell the lab personnel immediately.*
- *Plan to eat and take your blood sugar medication following your stress test.*

### **What Should I Wear the Day of the Test?**

*Wear soft-soled shoes suitable for walking and comfortable clothes. Do not bring valuables.*

### **What Happens During the Exercise Stress Test?**

*First, a technician will gently clean 10 small areas on your chest and place electrodes (small, flat, sticky patches) on these areas. The electrodes are attached to an electrocardiograph monitor (ECG or EKG) that charts your heart's electrical activity during the test.*

*Before you start exercising, the technician will perform an EKG, to measure your heart rate at rest and will take your blood pressure.*

*You will begin to exercise by walking on a treadmill or pedaling a stationary bicycle. The rate of exercise, or degree of difficulty will gradually increase. You will be asked to exercise until you feel exhausted.*

*At regular intervals, the lab personnel will ask how you are feeling. Please tell them if you feel chest, arm or jaw pain or discomfort, short of breath, dizzy, lightheaded or any other unusual symptoms. It is normal for your heart rate, blood pressure, breathing rate and perspiration to increase during the test. The lab personnel will watch for any symptoms or changes on the ECG monitor that suggest the test should be stopped.*

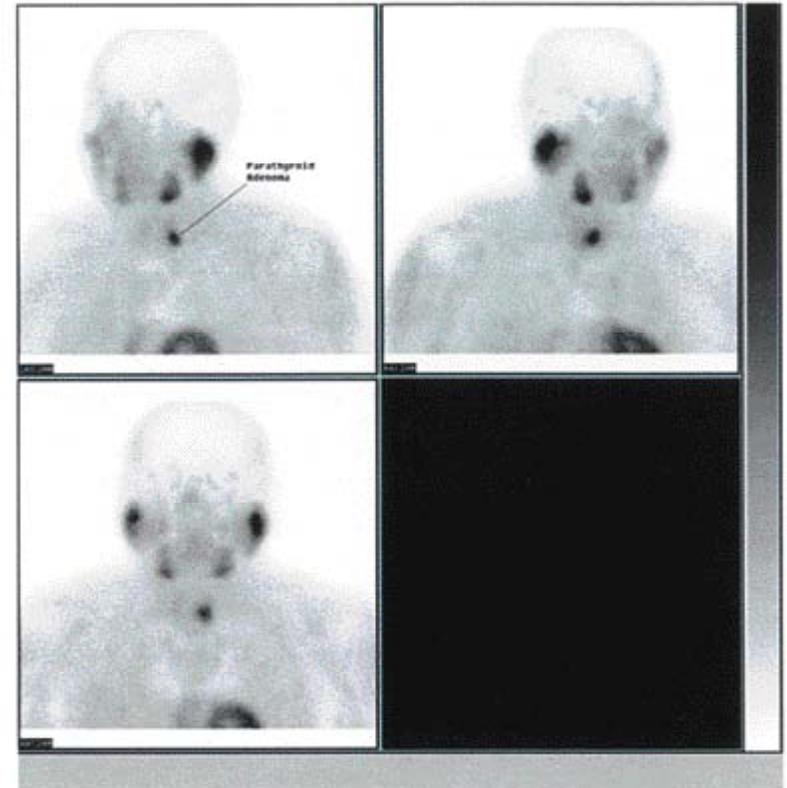
*After the test you will walk or pedal slowly for a couple of minutes to cool down. Your heart rate, blood pressure and ECG will continue to be monitored until the levels begin returning to normal.*

*Although the appointment lasts about 60 minutes, the actual exercise time is usually between seven and 12 minutes.*

*Ask your doctor if you have any questions about the exercise stress test.*

## **PARATHYROID**

*A parathyroid scan is a diagnostic nuclear medicine procedure used to evaluate abnormalities involving parathyroid, which are located on the back side of the thyroid gland.*



### **What is a parathyroid scan?**

*A parathyroid scan is a nuclear medicine exam that uses a radioactive compound to diagnose and localize parathyroid adenoma. It is a form of radiology, because radiation is used to capture pictures of the human body.*

### **How does the scan work?**

*You will be given a small dose of radioactive material through an intravenous (IV) line. This compound, called a tracer, collects in the parathyroid tissue and gives off gamma rays. The gamma camera detects the rays and then produces pictures of parathyroid tissue.*

### **How should I prepare for the scan?**

- *No preparation is needed.*
- *A patient who is unable to remain still for an extended period of time may require sedation.*
- *Women who are pregnant or breastfeeding should not have this test.*

### **How is the scan performed?**

1. *You will be given a small dose of a radioactive material intravenously (IV). This compound, called a tracer, collects in the parathyroid and will give off gamma rays.*
2. *The gamma camera detects the rays. A computer will then produce pictures of the parathyroid based on the detected gamma rays.*
3. *The technologist will take pictures right after the injection, 1 hour and 2 hours later.*
4. *The imaging involves lying flat while the camera takes pictures of your parathyroid. You must not move during the time the camera is taking pictures. If you move, the pictures will be blurry and may have to be repeated. The*

*technologist will help make you comfortable. You will be able to get up between imaging times.*

5. *The total time will take about 3 to 4 hours.*

### **What will I feel during the scan?**

- *Some minor discomfort during a nuclear medicine procedure may arise from the IV.*
- *Lying still on the exam table may be hard for some patients.*
- *Most of the radioactivity passes out of your body in urine or stool. The rest simply goes away over time.*

### **Who interprets the results and how do I get them?**

*When the test is over, the nuclear medicine doctor will review your images, prepare a written report, and discuss the results with your doctor. Your doctor will then talk with you about the results and discuss your treatment options. Talk to your doctor to find out whether or not you will need to restart any medications that you stopped for this exam.*

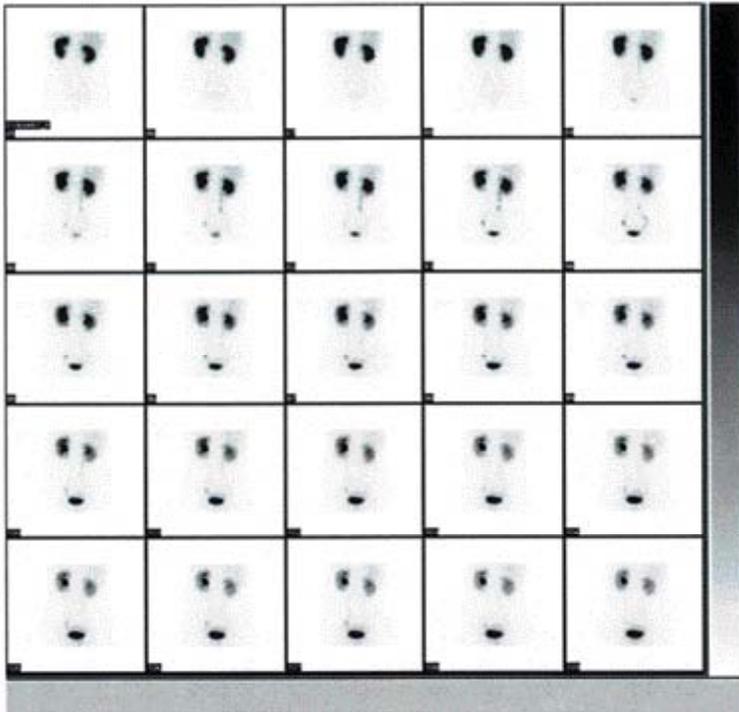
# Renogram

## Alternative Names

Renogram; Kidney scan, Renal scan

## Definition

A renal scan is a nuclear medicine examination that uses small amounts of radioactive materials (radioisotopes) to measure the function of the kidneys.



## How the Test is Performed

The process outlined below is a description of how a typical renal scan may go -- but the details may vary from place to place and according to a person's specific needs. A renal scan is similar to (and in fact, may be a continuation of) a renal perfusion scintiscan.

You will be asked to lie on the scanner table. Pressure (from a tourniquet or blood pressure cuff) is applied to the upper arm, which distends the veins of the arm. The inner elbow is scrubbed with antiseptic, and a small amount of radioisotope is injected into a vein (the radioisotope used may vary depending on the portion of kidney function that is of particular interest in the study).

The pressure on the upper arm is then released, which allows the isotope to travel through the bloodstream as a small, concentrated "package." A short time later, the kidneys are scanned. Several images are taken, each lasting 1 or 2 seconds, with the total scan time about 30 minutes to 1 hour. The images are analyzed by a computer after the scan is completed and can give detailed information about particular kidney functions (such as glomerular filtration rate, which reflects how much blood the kidney filters over time).

After the scan, no recovery time is required. You may be asked to drink plenty of fluids and urinate frequently to help excrete the radioactive material from the body.

## How to Prepare for the Test

There is usually no need for fasting, special diets, or preliminary medications. Discuss with your health care professional any nonsteroidal anti-inflammatory drugs (NSAIDs) or blood pressure medications you are currently taking to see if they will interfere with the exam. You may be asked to drink additional fluids before the scan.

You must sign a consent form. You will wear a hospital gown. Remove jewelry, dentures, and metallic objects before the scan.

## How the Test Will Feel

There is a sharp prick when the isotope is injected into the vein. You do not feel the isotope. You do not feel the scan, although the table may be hard or cold. You will need to lie still during the scan.

## Why the Test is Performed

The test evaluates the size, position, shape, and function of the

*kidneys. A renal scan is particularly useful when there is a known sensitivity to the contrast media used in an IVP or other X-rays, or when there is underlying kidney insufficiency (reduced kidney function). Renal scan is commonly used after a kidney transplant to evaluate kidney function and to look for signs of transplant rejection.*

*A renal scan may be used to evaluate kidney function in people with hypertension.*

### **What Abnormal Results Mean**

*Abnormal results indicate reduced kidney function(s). This may occur with acute or chronic renal failure, as complications of a kidney transplant (both surgical complications and transplant rejection), glomerulonephritis, or other kidney disorders.*

*Additional conditions under which the test may be performed:*

- *Acute arterial occlusion of the kidney*
- *Acute bilateral obstructive uropathy*
- *Bilateral hydronephrosis*
- *Carcinoma of the renal pelvis or ureter*
- *Chronic bilateral obstructive uropathy*
- *Complicated UTI (pyelonephritis)*
- *Injury of the kidney and ureter*
- *Pyelonephritis; acute*
- *Renovascular hypertension*

### **Risks**

*The risks are essentially the same as for X-rays (radiation) and for needle pricks.*

*There is a slight amount of radiation from the radioisotope. Most of this radiation exposure occurs to the kidneys and bladder as the isotope is excreted. Virtually all radiation is gone from the body in 24 hours. However, because of the slight exposure to radiation, caution is advised if you are pregnant or breastfeeding.*

*Any time the body is penetrated (such as by a needle prick) there is a risk for infection. Injection into a vein also carries a slight risk for bleeding. The risk is no greater for renal perfusion scan than for intravenous injection of any sort.*

*Extremely rarely, a person will exhibit an allergic reaction to the radioisotope, which may include severe anaphylaxis.*

### **Considerations**

*A scan that shows reduced kidney function may help identify the cause of the problem. Congenital (present from birth) or other abnormalities of kidney shape or size may contribute to an error in interpreting results of the scan because glomerular filtration rate and other functions are calculated based on normal kidney size and shape. Tests of some functions may require delayed images (1 to 4 hours later).*

*Advantages of the scan are the ability to determine kidney function without exposure to contrast agents and the ability to obtain quantitative information that may not be obtainable by other procedures.*

## **Testicular Scan**

*A testicular scan uses a camera to take pictures of the testicles after a radioactive tracer accumulates in testicular tissues nuclear medicine test.*

*During a testicular scan, the tracer substance is injected into a*

vein in the arm. It travels through the bloodstream to the testicles. Areas of the testicles where the tracer accumulates in abnormal amounts may indicate some types of tumors. The tracer may also indicate a pocket of fluid (cyst) or infection (abscess).

A testicular scan may be done in an emergency to evaluate the cause of sudden, painful swelling of a testicle, which can be caused by a twisted spermatic cord inside the testicle. This condition is called testicular torsion and needs immediate medical evaluation and treatment.

Testicular ultrasound has largely replaced testicular scans to investigate possible testicular tumors and testicular torsion.

### **Why It Is Done**

A testicular scan is done to:

- Determine the cause of a painful, swollen testicle.
- Assess the damage to the testicles caused by an injury.
- Assess the flow of blood within the testicles.

### **How To Prepare**

No special preparation is needed for a testicular scan.

You may be asked to sign a consent form before the test. Talk to your doctor about any concerns you have regarding the need for the test, its risks, how it will be done, or what the results will indicate.

### **How It Is Done**

A testicular scan is usually done by a nuclear medicine technologist. The scan pictures are usually interpreted by a radiologist or nuclear medicine specialist.

You will need to remove any jewelry that might interfere with the scan. You may need to take off all or most of your clothes, but you will be given a cloth or paper covering to use during the test.

The technologist cleans the site on your arm where the radioactive tracer will be injected. A small amount of the radioactive tracer is then injected.

You will lie on your back on a table and your penis will be taped to your abdomen to prevent it from interfering with the scan. A sling or towel may be used to support the testicles under the scanner. After the radioactive tracer is injected, the camera will scan for radiation released by the tracer and produce pictures of the tracer in your testicles. Two scans are done about 15 minutes apart. You need to lie very still during each scan to avoid blurring the pictures. The camera does not produce any radiation, so you are not exposed to any additional radiation while the scan is being done.

A testicular scan takes about 45 minutes.

### **How It Feels**

You may feel nothing at all from the needle puncture when the tracer is injected, or you may feel a brief sting or pinch as the needle goes through the skin. Otherwise, a testicular scan is usually painless. You may find it uncomfortable to remain still during the scan, especially if your testicles are sore. Ask for a pillow or blanket to make yourself as comfortable as possible before the scan begins.

### **Risks**

Allergic reactions to the radioactive tracer are rare. Most of the tracer will be eliminated from your body (through your urine or stool) within a day, so be sure to promptly flush the toilet and thoroughly wash your hands with soap and water. The amount of radiation is so small that it is not a risk for people to come in contact with you following the test.

Occasionally, some soreness or swelling may develop at the injection site. These symptoms can usually be relieved by applying moist, warm compresses to your arm.

There is always a very slight risk of damage to cells or tissue from being exposed to any radiation, including the low level of radiation released by the radioactive tracer used for this test.

## Results

A testicular scan uses a camera to take pictures of the testicles after a radioactive tracer accumulates in testicular tissues (nuclear medicine test). The results of a testicular scan are usually available within 2 days. In an emergency, results can be available within an hour.

Testicular scan	
<b>Normal:</b>	The radioactive tracer flows evenly through the testicles. No accumulations of the tracer are found in any of the testicles.
<b>Abnormal:</b>	The tracer does not flow evenly through the testicles, indicating narrowing of, blockage of, or damage to the blood vessels in the testicles. This could indicate that blood flow has been reduced by a twisted spermatic cord inside the testicle. This is called testicular torsion.
	Areas where the tracer accumulates in an abnormal amount could indicate a condition such as a cyst, tumor, pocket of infection (abscess), a blood clot or inflammation of the tubes (ducts) that carry sperm (epididymis). This is called epididymitis.

## What Affects the Test

The results of a testicular scan may not be accurate if you cannot remain still during the test.

## What To Think About

- Testicular ultrasound has largely replaced testicular scans to investigate possible testicular torsion or tumors in the testicles.
- Abnormal results from a testicular scan may be further investigated by other tests, such as a testicular biopsy, an ultrasound test, or X-ray tests.

- If a testicular scan is done for a young boy, a parent can accompany him while the test is being done.

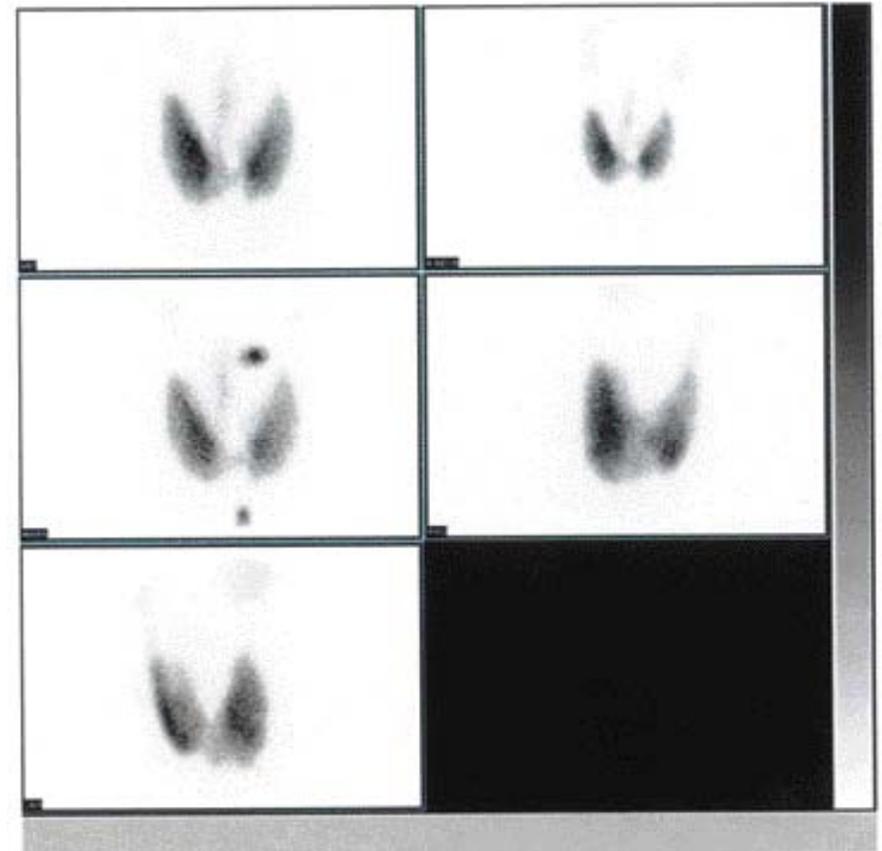
## THYROID SCAN

### Alternative Names

Scan - thyroid; Radioactive iodine screening test - thyroid; RAUI; Nuclear scan - thyroid

### Definition

A thyroid scan is a nuclear medicine nuclear medicine examination that uses radioactive iodine to check for hyperthyroidism, thyroid cancer, or other thyroid gland growths.



## How the Test is Performed

*You will be given a pill that contains radioactive iodine, and then you will wait as the iodine collects in the thyroid. The first scan is usually 4 - 6 hours after the iodine pill is taken. Another scan may be taken 24 hours later. Additional or alternative scans may be done using a compound containing technetium.*

*After the radioactive iodine has been absorbed by the thyroid, you will lie on your back on a movable table with your neck and chest positioned under the scanner. The scanner detects the location and intensity of the rays given off by the radioactive material. During this part of the procedure, you must lie still to let the scanner get a clear image. A computer displays images of the thyroid.*

## How to Prepare for the Test

*You must sign a consent form. You may be told not to eat after midnight the night before the exam. Consult the health care provider if you are taking any medications that may need to be regulated, such as thyroid medication and anything with iodine in it. Remove jewelry, dentures, or other metals, because they may interfere with the image.*

## How the Test Will Feel

*Some patients find remaining still during the test uncomfortable.*

## Why the Test is Performed

*This test is done if your doctor suspects you may have thyroid cancer or thyroid nodules.*

## Normal Results

*The thyroid appears the correct size, shape, and in the proper location. It appears an even gray color on the computer image.*

## What Abnormal Results Mean

*If the thyroid is enlarged or pushed off to one side, this could indicate a tumor. Nodules will absorb more or less iodine and will appear darker or lighter on the scan (usually lighter if tumor). If part of the thyroid appears lighter, it may indicate there is possible thyroid dysfunction.*

*Additional conditions under which the test may be performed:*

- *Anaplastic carcinoma of the thyroid*
- *Colloid nodular goiter*
- *Goiter*
- *Medullary carcinoma of thyroid*
- *Multiple endocrine neoplasia (MEN) II*
- *Papillary carcinoma of the thyroid*
- *Toxic nodular goiter*

## Risks

*All radiation has possible side effects. There is a very small amount of radiation in the radioisotope ingested during this test, but women who are nursing or pregnant should discuss the risks to the fetus or infant with their health care providers before taking this test.*

*The concerns regarding radiation side effects are taken into consideration when the test is ordered, but the benefits of taking the test usually far outweigh the risks.*

## Considerations

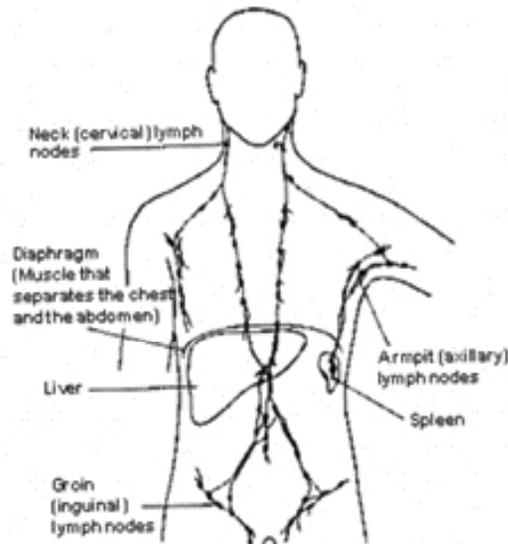
*Thyroid scans using radionuclides are used with other studies, such as blood tests and ultrasound, to evaluate the thyroid. Your doctor may send you for more than one type of test.*

# Lymphoscintigraphy

## What is Lymphoscintigraphy?

Lymphoscintigraphy provides a view of the workings of the lymphatic system, which is a network of small channels, like arteries and veins, that transport the fluid and cells of the immune system through the lymph nodes and throughout the body. This fluid, called lymph, normally flows slowly from the periphery toward the center of the body and into the general circulation. If lymphatic flow is blocked, the areas of drainage that are affected can become swollen.

A scintigram is a type of picture that uses a radiopharmaceutical (a radioactive drug), which is injected or taken orally, that makes the lymphatic system visible to specialized cameras. The study is performed in the Nuclear Medicine section of the hospital, where the radiopharmaceuticals are prepared and the pictures are taken. Lymphoscintigraphy can be helpful for localizing points of blockage and is also important for identifying abnormal lymph nodes and planning a biopsy or surgery for suspicious areas. Generally, the radiation dose is similar to that of a standard x-ray examination.



## What are some common uses of the procedure?

Lymphoscintigraphy can assist the physician in diagnosing diseases. It can help detect tumors, infection and other disorders such as the following:

- Lymphoscintigraphy can help diagnose lymphedema, a condition in which lymphatic fluid accumulates in soft tissues and may lead to inflammation and obstruction. This nuclear medicine test has all but replaced lymphangiography, a diagnostic x-ray procedure that used an oil-based contrast material that required surgical incisions on both feet to expose and inject the lymphatics directly.
- Lymph flow in an arm or leg may be evaluated with lymphoscintigraphy by injecting radioactive material into a web space between the fingers or toes and recording images for 60 minutes. Local anesthesia is not necessary.
- When planning surgery for a breast tumor, it is helpful to assess the lymphatic drainage beforehand to identify the sentinel lymph node (the first lymph node that receives lymph drainage from the tumor site) for excisional biopsy. A radiopharmaceutical is injected either just beneath the skin around the areola (nipple); at two to four sites around the tumor; beneath the skin above the tumor; or into the tumor itself on the day of surgery. Imaging usually is completed within 30 minutes, but may take up to one to two hours. Lymphoscintigraphy of the breast is very safe. Side effects are infrequent, and morbidity is much reduced compared with axillary lymph node dissection, which formerly was the routine staging procedure for patients with breast cancer and no obvious spread (metastasis).
- Malignant melanoma is an aggressive form of skin cancer that may spread rapidly to distant body sites. Lymphoscintigraphy may be performed preoperatively in order to identify the sentinel lymph node. A tumor-negative sentinel lymph node is strong evidence that there has not been spread of the tumor. This is important for staging the disease and planning treatment management.

## **How should I prepare for the procedure?**

*No special preparation is needed for lymphoscintigraphy.*

## **What does the equipment look like?**

*During lymphoscintigraphy you will lie down on a scanning table. Consequently, the only piece of equipment you may notice is the specialized nuclear imaging camera used during the procedure. It is a large, round device enclosed in a metallic housing and suspended over the examination table. The camera sometimes is located within a large, doughnut-shaped structure similar in appearance to a computed tomography (CT) scanner. A nearby computer console, often in an adjacent room, processes the data from the procedure.*

## **How does the procedure work?**

*With regular x-ray examinations, an image of the body is made by passing x-rays through the body part from an outside x-ray source. In contrast, with nuclear medicine a radioactive substance called a radiopharmaceutical or radiotracer localizes in a certain body part (or parts) which emits gamma rays that are detected by a gamma camera. The gamma camera sends the information to a computer that develops the image. Scanning times may vary considerably.*

*The most commonly used radiopharmaceutical in the United States for lymphoscintigraphy is called technetium-99m sulfur colloid. It typically loses its radioactivity in less than 24 hours.*

## **How is the procedure performed?**

*You will be asked to lie face up beneath or next to a gamma camera. When assessing lymph drainage to identify the sentinel lymph node, as in patients with melanoma, three to five injections of radiopharmaceutical are given into the skin surrounding the site of the melanoma. For breast cancer, the injections are given through the skin near the tumor or around the areola. All injections are made using a very small needle.*

*In lymphoscintigraphy performed for leg or arm edema, the radiopharmaceutical is injected into the skin between the first and second fingers or toes of each hand or foot.*

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*Imaging begins immediately after injection and is repeated at five-minute intervals for 45 to 60 minutes. Often, both sides are studied so that the normal and abnormal sides can be compared. You may also be asked to exercise lightly for about 10 minutes, either by walking for leg exams or by doing handgrip or lifting exercises for arm exams. Images are acquired after exercise and, in some cases, delayed images are needed at one- to two-hour intervals for up to six hours, or even up to 24 hours.*

*For patients with breast cancer, images will be made of the underarm regions and breast/chest. For melanoma patients, images will be made of the underarms, head, neck and both groins. In most melanoma patients, imaging will take three to four hours. Markings are made on the skin to show where lymph nodes are located.*

## **What will I experience during the procedure?**

*Lymphoscintigraphy is an outpatient procedure. No anesthesia is needed unless a lymph node biopsy is performed in the operating room immediately following lymphoscintigraphy in order to detect involvement by melanoma or breast cancer. It is important that you avoid moving while the images are recorded.*

*Most patients can resume regular activities immediately after the procedure. The small amount of radioactivity in your body will decrease due to the natural process of radioactive decay over several hours.*

## **Who interprets the results and how do I get them?**

*Most patients undergo lymphoscintigraphy because their primary care physician or surgeon has recommended it. A radiologist, a physician who has specialized training in nuclear medicine and other medical imaging procedures, will interpret the images and forward a report to your physician.*

## **What are the benefits vs. risks?**

### **Benefits**

- *The functional information provided by nuclear medicine examinations such as lymphoscintigraphy is unique and currently unattainable by using other imaging procedures. For many diseases, nuclear medicine studies yield the most useful information needed to make a diagnosis and to*

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*determine appropriate treatment, if any.*

- *Sentinel lymph node biopsy following lymphoscintigraphy is a useful means of diagnosing and staging melanoma and learning whether the disease has spread from its primary site.*
- *Lymphoscintigraphy and sentinel lymph node biopsy are less traumatic than the alternatives of staging breast cancer or melanoma by surgical lymph node dissections.*
- *Computers are involved in the generation of images, making it possible to measure function and quantify it in addition to identifying abnormalities.*
- *Because lymphoscintigraphy is generally performed according to standardized protocols, the type of examination done at one hospital is likely to be similar to that performed at other hospitals, making the information easy to understand and easy to transfer to all doctors who may be involved in your care.*

### **Risks**

- *Because the doses of radiopharmaceutical administered are small, nuclear medicine procedures such as lymphoscintigraphy result in minimal radiation exposure. Nuclear medicine has been used for more than five decades, and there are no known long-term adverse effects from such low-dose exposure.*
- *As with all radiological procedures, it is important that you inform your physician and the radiological technologist if you are pregnant. In general, exposure to radiation during pregnancy should be kept to a minimum. Allergic reactions to radiopharmaceuticals may occur but are extremely rare.*
- *Injection of the radiopharmaceutical may cause slight pain and redness.*

### **What are the limitations of Lymphoscintigraphy?**

*Nuclear medicine procedures such as lymphoscintigraphy are time-consuming. They involve administration of a radiopharmaceutical, acquisition of images, and interpretation of the results. Imaging can take up to an hour and sometimes longer to perform.*

## **Dacryocystogram**

### **Purpose**

*A simple noninvasive test for defining the patency of the lacrimal duct is accomplished with the <sup>99m</sup>Tc pertechnetate dacryocystography. Functional obstruction can be visualized unlike the radiographic contrast study, in which the duct is catheterized.*

### **Patient Prep**

*No special preparation is required.*

### **What happens during the study?**

*Radioactive eyedrops will be administered to the eyeball and pictures are acquired for up to 45 minutes. Patients are encouraged to hold his/her head still during the picture-taking process.*

### **Interpretation**

*Normal images should show activity in the area of the nose in 10 to 15 minutes. The level of obstruction can be well demonstrated on images.*