

## **A1C test**

### **Definition**

A1C is a lab test that shows the average level of blood sugar (glucose) over the previous 3 months. It shows how well you are controlling your diabetes.

### **Alternative Names**

HbA1C test; Glycated hemoglobin test; Glycohemoglobin test; Hemoglobin A1C; Diabetes - A1C; Diabetic - A1C

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

A blood sample is needed. Two methods are available:

- Blood drawn from a vein. This is done at a lab.
- Finger stick. This can be done in your health care provider's office. Or, you may be prescribed a kit that you can use at home. In general, this test is less accurate than the other methods.

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

No special preparation is needed. The food you have recently eaten does not affect the A1C test, so you do not need to fast to prepare for this blood test.

### **How the Test will Feel**

With a finger stick, you may feel slight pain.

With blood drawn from a vein, you may feel a slight pinch or some stinging when the needle is inserted. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Your provider may order this test if you have diabetes. It shows how well you are controlling your diabetes.

The test may also be used to screen for diabetes.

Ask your provider how often you should have your A1C level tested. Usually, testing every 3 or 6 months is recommended.

### **Normal Results**

The following are the results when A1C is being used to diagnose diabetes:

- Normal (no diabetes): Less than 5.7%
- Pre-diabetes: 5.7% to 6.4%
- Diabetes: 6.5% or higher

If you have diabetes, you and your provider will discuss the correct range for you. For many people, the goal is to keep the level below 7%.

The test result may be incorrect in people with anemia, kidney disease, or certain blood disorders (thalassemia). Talk to your provider if you have any of these conditions. Certain medicines can also result in a false A1C level.

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An abnormal result means that you have had a high blood sugar level over a period of weeks to months.

If your A1C is above 6.5% and you do not already have diabetes, you may be diagnosed with diabetes.

If your level is above 7% and you have diabetes, it often means that your blood sugar is not well controlled. You and your provider should determine your target A1C.

The higher your A1C, the higher the risk that you will develop problems such as:

- Eye disease
- Heart disease
- Kidney disease
- Nerve damage
- Stroke

If your A1C stays high, talk to your provider about how to best manage your blood sugar.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Other risks of having blood drawn are slight, but may include:

- Excessive bleeding
- Multiple punctures to locate veins
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Abdominal CT scan**

### **Definition**

An abdominal CT scan is an imaging method. This test uses x-rays to create cross-sectional pictures of the belly area. CT stands for computed tomography.

### **Alternative Names**

Computed tomography scan - abdomen; CT scan - abdomen; CT abdomen and pelvis

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

You will lie on a narrow table that slides into the center of the CT scanner. Most often, you will lie on your back with your arms raised above your head.

Once you are inside the scanner, the machine's x-ray beam rotates around you. Modern spiral scanners can perform the exam without stopping.

A computer creates separate images of the belly area. These are called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the belly area can be made by stacking the slices together.

You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods of time.

In many cases, an abdominal CT is done with a pelvis CT.

The scan should take less than 30 minutes.

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

You need to have a special dye, called contrast, put into your body before some exams. Contrast helps certain areas show up better on the x-rays. Contrast can be administered in various ways.

Such as:

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.
- You may have to drink the contrast before the exam. When you drink it will depend on the type of exam being done. Contrast has a chalky taste, although some are flavored so they taste a little better. The contrast you drink will pass out of your body through your stools and is harmless.

Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test to safely receive this substance.

Before receiving the contrast, tell your provider if you take the diabetes medicine metformin.

People taking this medicine may have to stop taking it for a while before the test.

Let your provider know if you have any kidney problems. The IV contrast can worsen kidney function.

Too much weight can damage the scanner. Find out if the CT machine has a weight limit if you weigh more than 300 pounds (135 kg).

You will need to take off your jewelry and wear a hospital gown during the study.

### **How the Test will Feel**

Lying on the hard table may be a little bit uncomfortable.

If you have contrast through a vein (IV), you may have:

- Slight burning sensation
- Metallic taste in the mouth
- Warm flushing of the body

These feelings are normal and go away within a few seconds.

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

An abdominal CT scan makes detailed pictures of the structures inside your belly very quickly.

This test may be used to look for:

- Cause of blood in the urine
- Cause of abdominal pain or swelling
- Cause of abnormal blood test results such as liver or kidney problems
- Hernia
- Cause of a fever
- Masses and tumors, including cancer
- Infections or injury
- Kidney stones
- Appendicitis

### **What Abnormal Results Mean**

The abdominal CT scan may show some cancers, including:

- Cancer of the renal pelvis or ureter
- Colon cancer
- Hepatocellular carcinoma
- Lymphoma
- Melanoma
- Ovarian cancer
- Pancreatic cancer
- Pheochromocytoma
- Renal cell carcinoma (kidney cancer)
- Spread of cancers that began outside the belly

The abdominal CT scan may show problems with the gallbladder, liver, or pancreas, including:

- Acute cholecystitis
- Alcoholic liver disease
- Cholelithiasis
- Pancreatic abscess
- Pancreatic pseudocyst
- Pancreatitis
- Blockage of bile ducts

The abdominal CT scan may reveal the following kidney problems:

- Blockage of the kidneys
- Hydronephrosis (kidney swelling from the backflow of urine)
- Kidney infection
- Kidney stones
- Kidney or ureter damage
- Polycystic kidney disease

Abnormal results may also be due to:

- Abdominal aortic aneurysm
- Abscesses
- Appendicitis
- Bowel wall thickening
- Crohn disease
- Renal artery stenosis
- Renal vein thrombosis

### **Risks**

Risks of CT scans include:

- Allergy to contrast dye
- Exposure to radiation
- Damage to kidney function from contrast dye

CT scans expose you to more radiation than regular x-rays. Many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. Most modern scanners are able to reduce the radiation exposure. Talk to your provider about this risk and the benefit of the test for getting a correct diagnosis of your medical problem.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

The most common type of contrast given into a vein contains iodine. If you have an iodine allergy, you may have nausea or vomiting, sneezing, itching, or hives if you get this type of contrast. If you must be given such contrast, your provider may give you antihistamines (such as Benadryl) or steroids before the test.

Your kidneys help remove IV dye from the body. You may need extra fluids after the test to help flush the iodine out of your body if you have kidney disease or diabetes.

Rarely, the dye may cause a life-threatening allergic response. Tell the scanner operator right away if you have any trouble breathing during the test. Scanners come with an intercom and speakers, so the operator can hear you at all times.

### **Abdominal MRI scan**

#### **Definition**

An abdominal magnetic resonance imaging scan is an imaging test that uses powerful magnets and radio waves. The waves create pictures of the inside of the belly area. It does not use radiation (x-rays).

Single magnetic resonance imaging (MRI) images are called slices. The images can be stored on a computer, viewed on a monitor, or scanned to a disc. One exam produces dozens or sometimes hundreds of images.

#### **Alternative Names**

Nuclear magnetic resonance - abdomen; NMR - abdomen; Magnetic resonance imaging - abdomen; MRI of the abdomen

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

You may be asked to wear a hospital gown or clothing without metal zippers or snaps (such as sweatpants and a t-shirt). Certain types of metal can cause blurry images.

You will lie on a narrow table. The table slides into a large tunnel-shaped scanner.

Some exams require a special dye (contrast). Most of the time, the dye is given during the test through a vein (IV) in your hand or forearm. The dye helps the radiologist see certain areas more clearly.

During the MRI, the person who operates the machine will watch you from another room. The test lasts about 30 to 60 minutes, but it may take longer.

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

You may be asked not to eat or drink anything for 4 to 6 hours before the scan.

Tell your health care provider if you are afraid of close spaces (have claustrophobia). You may be given a medicine to help you feel sleepy and less anxious. Your provider may also suggest an open MRI, in which the machine is not as close to your body.

Before the test, tell your provider if you have:

- Artificial heart valves
- Brain aneurysm clips
- Heart defibrillator or pacemaker
- Inner ear (cochlear) implants
- Kidney disease or dialysis (you may not be able to receive contrast)
- Recently placed artificial joints
- Certain types of vascular stents
- Worked with sheet metal in the past (you may need tests to check for metal pieces in your eyes)

Because the MRI contains strong magnets, metal objects are not allowed into the room with the MRI scanner. Avoid carrying items such as:

- Pocketknives, pens, and eyeglasses
- Watches, credit cards, jewelry, and hearing aids
- Hairpins, metal zippers, pins, and similar items
- Removable dental implants

#### **How the Test will Feel**

An MRI exam causes no pain. You may get medicine to relax you if you have a problem lying still or are very nervous. Moving too much can blur MRI images and cause errors.

The table may be hard or cold, but you can ask for a blanket or pillow. The machine makes loud thumping and humming noises when turned on. You can wear ear plugs to help reduce the noise. An intercom in the room allows you to speak to someone at any time. Some MRIs have televisions and special headphones to help you pass time.

There is no recovery time, unless you were given a medicine to help you relax. After an MRI scan, you can go back to your normal diet, activity, and medicines.

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

An abdominal MRI provides detailed pictures of the belly area from many views. It is often used to clarify findings from earlier x-rays or CT scans.

This test may be used to look at:

- Blood flow in the abdomen
- Blood vessels in the abdomen
- The cause of abdominal pain or swelling
- The cause of abnormal blood test results, such as liver or kidney problems
- Lymph nodes in the abdomen
- Masses in the liver, kidneys, adrenals, pancreas, or spleen

MRI can distinguish tumors from normal tissues. This can help the doctor know more about the tumor such as size, severity, and spread. This is called staging.

In some cases it can give better information about masses in the abdomen than CT.

### **What Abnormal Results Mean**

An abnormal result may be due to:

- Abdominal aortic aneurysm
- Abscess
- Cancer or tumors that involves the adrenal glands, liver, gallbladder, pancreas, kidneys, ureters, intestines
- Enlarged spleen or liver
- Gallbladder or bile duct problems
- Hemangiomas
- Hydronephrosis (kidney swelling from the backflow of urine)
- Kidney infection
- Kidney damage or diseases
- Kidney stones
- Enlarged lymph nodes
- Obstructed vena cava
- Portal vein obstruction (liver)
- Blockage or narrowing of the arteries that supply the kidneys
- Renal vein thrombosis
- Kidney or liver transplant rejection
- Cirrhosis of the liver
- Spread of cancers that began outside the belly

### **Risks**

MRI does not use ionizing radiation. No side effects from the magnetic fields and radio waves have been reported.

The most common type of contrast (dye) used is gadolinium. It is very safe. Allergic reactions are rare but can occur. If you have a history of severe allergic reactions to other medicines you should notify your doctor. In addition, gadolinium can be harmful to people with kidney problems who need dialysis. Tell your provider before the test if you have kidney problems.

The strong magnetic fields created during an MRI can cause heart pacemakers and other implants not to work as well. The magnets can also cause a piece of metal inside your body to move or shift.

### **Abdominal tap**

#### **Definition**

An abdominal tap is used to remove fluid from the area between the belly wall and the spine. This space is called the abdominal cavity.

#### **Alternative Names**

Peritoneal tap; Paracentesis; Ascites - abdominal tap; Cirrhosis - abdominal tap; Malignant ascites - abdominal tap

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

This test may be done in a health care provider's office, treatment room, or hospital.

The puncture site will be cleaned and shaved, if necessary. You then receive a local numbing medicine. The tap needle is inserted 1 to 2 inches (2.5 to 5 cm) into the abdomen. Sometimes, a small cut is made to help insert the needle. The fluid is pulled out into a syringe.

The needle is removed. A dressing is placed on the puncture site. If a cut was made, one or two stitches may be used to close it.

Sometimes, ultrasound is used to guide the needle. An ultrasound uses sound waves to make the image and not x-rays. It does not hurt.

There are 2 kinds of abdominal taps:

- Diagnostic tap -- A small amount of fluid is taken and sent to the laboratory for testing.
- Large volume tap -- Several liters may be removed to relieve abdominal pain and fluid buildup.

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

Let your provider know if you:

- Have any allergies to medicines or numbing medicine
- Are taking any medicines (including herbal remedies)
- Have any bleeding problems
- Might be pregnant

### **How the Test will Feel**

You may feel a slight sting from the numbing medicine, or pressure as the needle is inserted.

If a large amount of fluid is taken out, you may feel dizzy or lightheaded. Tell the provider if you feel dizzy or lightheaded.

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

Normally, the abdominal cavity contains only a small amount of fluid. In certain conditions, large amounts of fluid can build up in this space.

An abdominal tap can help diagnose the cause of fluid buildup or the presence of an infection. It may also be done to remove a large amount of fluid to reduce belly pain.

### **Normal Results**

Normally, there should be little or no fluid in the abdominal space.

### **What Abnormal Results Mean**

An exam of abdominal fluid may show:

- Cancer that has spread to the abdominal cavity (most often cancer of the ovaries)
- Cirrhosis of the liver
- Damaged bowel
- Heart disease
- Infection
- Kidney disease
- Pancreatic disease

### **Risks**

There is a slight chance that the needle could puncture the bowel, bladder, or a blood vessel in the abdomen. If a large quantity of fluid is removed, there is a slight risk of lowered blood pressure and kidney problems. There is also a slight chance of infection.

### **Abdominal ultrasound**

#### **Definition**

Abdominal ultrasound is a type of imaging test. It is used to look at organs in the abdomen, including the liver, gallbladder, spleen, pancreas, and kidneys. The blood vessels that lead to some of these organs, such as the inferior vena cava and aorta, can also be examined with ultrasound.

#### **Alternative Names**

Ultrasound - abdomen; Abdominal sonogram; Right upper quadrant sonogram

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

An ultrasound machine makes images of organs and structures inside the body. The machine sends out high-frequency sound waves that reflect off body structures. A computer receives these waves



and uses them to create a picture. Unlike with x-rays or CT scans, this test does not expose you to ionizing radiation.

You will be lying down for the procedure. A clear, water-based conducting gel is applied to the skin over the abdomen. This helps with the transmission of the sound waves. A handheld probe called a transducer is then moved over the abdomen.

You may need to change position so that the health care provider can look at different areas. You may also need to hold your breath for short periods during the exam.

Most of the time, the test takes less than 30 minutes.

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

How you will prepare for the test depends on the problem. You will likely be asked not to eat or drink for several hours before the exam. Your provider will go over what you need to do.

### **How the Test will Feel**

There is little discomfort. The conducting gel may feel a little cold and wet.

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

You may have this test to:

- Find the cause of abdominal pain
- Find the cause of kidney infections
- Diagnose and monitor tumors and cancers
- Diagnose or treat ascites
- Learn why there is swelling of an abdominal organ
- Look for damage after an injury
- Look for stones in the gallbladder or kidney
- Look for the cause of abnormal blood tests such as liver function tests or kidney tests
- Look for the cause of a fever

The reason for the test will depend on your symptoms.

### **Normal Results**

The organs examined appear normal.

### **What Abnormal Results Mean**

The meaning of abnormal results depends on the organ being examined and the type of problem. Talk to your provider if you have any questions or concerns.

An abdominal ultrasound can indicate conditions such as:

- Abdominal aortic aneurysm
- Abscess
- Appendicitis
- Cholecystitis
- Gallstones
- Hydronephrosis
- Kidney stones
- Pancreatitis (inflammation in pancreas)
- Spleen enlargement (splenomegaly)
- Portal hypertension
- Liver tumors
- Obstruction of bile ducts
- Cirrhosis

### **Risks**

There is no known risk. You are not exposed to ionizing radiation.

### **Abdominal wall fat pad biopsy**

#### **Definition**

An abdominal wall fat pad biopsy is the removal of a small part of the abdominal wall fat pad for laboratory study of the tissue.

#### **Alternative Names**

Amyloidosis - abdominal wall fat pad biopsy; Abdominal wall biopsy; Biopsy - abdominal wall fat pad

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

Needle aspiration is the most common method of taking an abdominal wall fat pad biopsy.

The health care provider cleans the skin on your belly area. Numbing medicine may be applied on the area. A needle is placed through the skin and into the fat pad under the skin. A small piece of the fat pad is removed with the needle. It is sent to a laboratory for analysis.

**How to Prepare for the Test**

No special preparation is usually necessary. However, follow any specific instructions your provider gives you.

**How the Test will Feel**

You may have some mild discomfort or feel pressure when the needle is inserted. Afterward, the area may feel tender or be bruised for several days.

**Why the Test is Performed**

The procedure is done most often to test for amyloidosis. Amyloidosis is a disorder in which abnormal proteins build up in tissues and organs, impairing their function. Clumps of the abnormal proteins are called amyloid deposits.

Diagnosing the disease in this way may avoid the need for a biopsy of a nerve or an internal organ, which is a more difficult procedure.

**Normal Results**

The fat pad tissues are normal.

**What Abnormal Results Mean**

In the case of amyloidosis, abnormal results mean there are amyloid deposits.

**Risks**

There is a slight risk of infection, bruising, or slight bleeding.

**Abdominal x-ray****Definition**

An abdominal x-ray is an imaging test to look at organs and structures in the abdomen. Organs include the spleen, stomach, and intestines.

When the test is done to look at the bladder and kidney structures, it is called a KUB (kidneys, ureters, bladder) x-ray.

**Alternative Names**

Abdominal film; X-ray - abdomen; Flat plate; KUB x-ray

**How the Test is Performed**

The test is done in a hospital radiology department. Or, it may be done in the health care provider's office by an x-ray technologist.

You lie on your back on the x-ray table. The x-ray machine is positioned over your abdominal area. You hold your breath as the picture is taken so that the picture will not be blurry. You may be asked to change position to the side or to stand up for additional pictures.

Men will have a lead shield placed over the testes to protect against the radiation.

**How to Prepare for the Test**

Before having the x-ray, tell your provider the following:

- If you are pregnant or think you could be pregnant
- Have an IUD inserted
- Have had a barium contrast x-ray in the last 4 days
- If you have taken any medicines such as Pepto Bismol in the last 4 days (this type of medicine can interfere with the x-ray)

You wear a hospital gown during the x-ray procedure. You must remove all jewelry.

**How the Test will Feel**

There is no discomfort. The x-rays are taken as you lie on your back, side, and while standing.

**Why the Test is Performed**

Your provider may order this test to:

- Diagnose a pain in the abdomen or unexplained nausea
- Identify suspected problems in the urinary system, such as a kidney stone
- Identify blockage in the intestine
- Locate an object that has been swallowed
- Help diagnose diseases, such as tumors or other conditions

**Normal Results**

The x-ray will show normal structures for a person your age.



### **What Abnormal Results Mean**

Abnormal findings include:

- Abdominal masses
- Buildup of fluid in the abdomen
- Certain types of gallstones
- Foreign object in the intestines
- Hole in the stomach or intestines
- Injury to the abdominal tissue
- Intestinal blockage
- Kidney stones

### **Risks**

There is low radiation exposure. X-rays are monitored and regulated to provide the minimum amount of radiation exposure needed to produce the image. Most experts feel that the risk is low compared to the benefits.

Pregnant women and children are more sensitive to the risks of the x-ray. Women should tell their provider if they are, or may be, pregnant.

### **ACE blood test**

#### **Definition**

The ACE test measures the level of angiotensin-converting enzyme (ACE) in the blood.

#### **Alternative Names**

Serum angiotensin-converting enzyme; SACE

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

A blood sample is needed.

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

Follow your health care provider's instructions for not eating or drinking for up to 12 hours before the test. If you are on steroid medicine, ask your provider if you need to stop the medicine before the test, because steroids can decrease ACE levels. **DO NOT** stop any medicine before talking to your provider.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test may be commonly ordered to help diagnose and monitor a disorder called sarcoidosis.

People with sarcoidosis may have their ACE level tested regularly to check how severe the disease is and how well treatment is working.

This test also helps confirm Gaucher disease and leprosy.

#### **Normal Results**

Normal values vary based on your age and the test method used. Adults have an ACE level less than 40 micrograms/L.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

Higher than normal ACE level may be a sign of sarcoidosis. ACE levels may rise or fall as sarcoidosis worsens or improves.

A higher than normal ACE level may also be seen in several other diseases and disorders, including:

- Cancer of the lymph tissue (Hodgkin disease)
- Diabetes
- Liver swelling and inflammation (hepatitis) due to alcohol use
- Lung disease such as asthma, cancer, chronic obstructive pulmonary disease, or tuberculosis
- Kidney disorder called nephrotic syndrome
- Multiple sclerosis
- Adrenal glands do not make enough hormones (Addison disease)

- Stomach ulcer
- Overactive thyroid (hyperthyroidism)
- Overactive parathyroid glands (hyperparathyroidism)

Lower than normal ACE level may indicate:

- Chronic liver disease
- Chronic kidney failure
- Eating disorder called anorexia nervosa
- Steroid therapy (usually prednisone)
- Therapy for sarcoidosis
- Underactive thyroid (hypothyroidism)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Excessive bleeding
- Infection (a slight risk any time the skin is broken)

### **Acetylcholine receptor antibody**

#### **Definition**

Acetylcholine receptor antibody is a protein found in the blood of many people with myasthenia gravis. The antibody affects a chemical that sends signals from nerves to muscles and between nerves in the brain.

This article discusses the blood test for acetylcholine receptor antibody.

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

A blood sample is needed. Most of the time, blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

Most of the time you do not need to take special steps before this test.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

This test is used to help diagnose myasthenia gravis.

#### **Normal Results**

Normally, there is no acetylcholine receptor antibody (or less than 0.05 nmol/L) in the bloodstream.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your doctor about the meaning of your specific test results.

The example above shows the common measurement for results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

An abnormal result means acetylcholine receptor antibody has been found in your blood. It confirms the diagnosis of myasthenia gravis in people who have symptoms. Nearly one half of people with myasthenia gravis that is limited to their eye muscles (ocular myasthenia gravis) have this antibody in their blood.

However, the lack of this antibody does not rule out myasthenia gravis. About 1 in 5 people with myasthenia gravis do not have signs of this antibody in their blood. Your provider may also consider testing you for the muscle specific kinase (MuSK) antibody.

### **Acid loading test (pH)**

#### **Definition**

The acid loading test (pH) measures the ability of the kidneys to send acid to the urine when there is too much acid in the blood. This test involves both a blood test and urine test.

**Alternative Names**

Renal tubular acidosis - acid loading test

**How the Test is Performed**

Before the test, you will need to take a medicine called ammonium chloride for 3 days. Follow instructions exactly on how to take it to ensure an accurate result.

Samples of urine and blood are then taken.

**How to Prepare for the Test**

Your health care provider will tell you to take ammonium chloride capsules by mouth for 3 days before the test.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away. The urine test involves only normal urination, and there is no discomfort.

**Why the Test is Performed**

This test is done to see how well your kidneys control the body's acid-base balance.

**Normal Results**

Urine with a pH less than 5.3 is normal.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

**What Abnormal Results Mean**

The most common disorder associated with an abnormal result is renal tubular acidosis.

**Risks**

There are no risks with providing a urine sample.

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

**Acid mucopolysaccharides****Definition**

Acid mucopolysaccharides is a test that measures the amount of mucopolysaccharides released into the urine either during one episode or over a 24-hour period.

Mucopolysaccharides are long chains of sugar molecules in the body. They are often found in mucus and in fluid around the joints.

**Alternative Names**

AMP; Dermatan sulfate - urine; Urine heparan sulfate; Urine dermatan sulfate; Heparan sulfate - urine

**How the Test is Performed**

For the 24-hour test, you must urinate into a special bag or container every time you use the bathroom. Most often, you will be given two containers. You will urinate directly into the smaller special container and then transfer that urine into the other larger container.

- On day 1, urinate into the toilet when you wake up in the morning.
- After the first urination, urinate into the special container every time you use the bathroom for the next 24 hours. Transfer the urine into the larger container and keep the larger container in a cool place or in a refrigerator. Keep this container tightly capped.
- On day 2, urinate into the container in the morning again when you wake up and transfer this urine to the larger container.
- Label the larger container with your name, the date, the time of completion, and return it as instructed.

For an infant:

Thoroughly wash the area around the urethra (the hole where urine flows out). Open a urine collection bag (a plastic bag with an adhesive paper on one end).

- For males, place the entire penis in the bag and attach the adhesive paper to the skin.
- For females, place the bag over the two folds of skin on either side of the vagina (labia). Put a diaper on the baby (over the bag).

Check the infant often, and change the bag after the infant has urinated. Empty the urine from the bag into the container provided by your health care provider.

Active babies can move the bag, causing the urine to go into the diaper. You may need extra collection bags.

When finished, label the container and return it as you have been told.

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

There is no special preparation needed.

### **How the Test will Feel**

The test involves only normal urination, and there is no discomfort.

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

This test is done to diagnose a rare group of genetic disorders called mucopolysaccharidoses (MPS). These include, Hurler, Scheie, and Hurler/Scheie syndromes (MPS I), Hunter syndrome (MPS II), Sanfilippo syndrome (MPS III), Morquio syndrome (MPS IV), Maroteaux-Lamy syndrome (MPS VI), and Sly syndrome (MPS VII).

Most of the time, this test is done in infants who may have a symptom or family history of one of these disorders.

### **Normal Results**

Normal levels vary with age and from lab to lab. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormally high levels could be consistent with a type of mucopolysaccharidosis. Further tests are needed to determine the specific type of mucopolysaccharidosis.

### **Acid-fast stain**

#### **Definition**

The acid-fast stain is a laboratory test that determines if a sample of tissue, blood, or other body substance is infected with the bacteria that causes tuberculosis (TB) and other illnesses.

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

Your health care provider will collect a sample of urine, stool, sputum, bone marrow, or tissue, depending on the location of the suspected infection.

The sample is then sent to a laboratory. Some of the sample is placed on a glass slide, stained, and heated. The cells in the sample hold onto the dye. The slide is then washed with an acid solution and a different stain is applied.

Bacteria that hold onto the first dye are considered "acid-fast" because they resist the acid wash. These types of bacteria are associated with TB and other infections.

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

Preparation depends on how the sample is collected. Your provider will tell you how to prepare.

#### **How the Test will Feel**

The amount of discomfort depends on how the sample is collected. Your provider will discuss this with you.

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

The test can tell if you are likely infected with the bacteria that cause TB and related infections.

#### **Normal Results**

A normal result means no acid-fast bacteria were found on the stained sample.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test result.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- TB
- Leprosy

- Nocardia infections (also caused by a bacteria)

### **Risks**

Risks depend on how the sample is collected. Ask your provider to explain the risks and benefits of the medical procedure.

### **ACTH blood test**

#### **Definition**

The ACTH test measures the level of adrenocorticotrophic hormone (ACTH) in the blood. ACTH is a hormone released from the pituitary gland in the brain.

#### **Alternative Names**

Serum adrenocorticotrophic hormone; Adrenocorticotrophic hormone; Highly-sensitive ACTH

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

A blood sample is needed.

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

Your doctor will likely ask you to have the test done early in the morning. This is important, because cortisol level varies throughout the day.

You may also be told to stop taking medicines that can affect the test results. These medicines include glucocorticoids such as prednisone, hydrocortisone, or dexamethasone. (Do not stop these medicines unless instructed by your provider.)

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

The main function of ACTH is to regulate the glucocorticoid (steroid) hormone cortisol. Cortisol is released by the adrenal gland. It regulates blood pressure, blood sugar, the immune system and the response to stress.

This test can help find the causes of certain hormone problems.

#### **Normal Results**

Normal values for a blood sample taken early in the morning are 9 to 52 pg/mL (2 to 11 pmol/L). Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

A higher-than-normal level of ACTH may indicate:

- Adrenal glands not producing enough cortisol (Addison disease)
- Adrenal glands not producing enough hormones (congenital adrenal hyperplasia)
- One or more of the endocrine glands are overactive or have formed a tumor (multiple endocrine neoplasia type I)
- Pituitary is making too much ACTH (Cushing disease), which is usually caused by a non-cancerous tumor of the pituitary gland
- Rare type of tumor (lung, thyroid, or pancreas) making too much ACTH (ectopic Cushing syndrome)

A lower-than-normal level of ACTH may indicate:

- Glucocorticoid medicines are suppressing ACTH production (most common)
- Pituitary gland not producing enough hormones, such as ACTH (hypopituitarism)
- Tumor of the adrenal gland that produces too much cortisol

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **ACTH stimulation test**

### **Definition**

The ACTH stimulation test measures how well the adrenal glands respond to adrenocorticotrophic hormone (ACTH). ACTH is a hormone produced in the pituitary gland that stimulates the adrenal glands to release a hormone called cortisol.

### **Alternative Names**

Test of adrenal reserve; Cosyntropin stimulation test; Cortrosyn stimulation test; Synacthen stimulation test; Tetracosactide stimulation test

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

The test is done the following way:

- Your blood is drawn.
- You then receive a shot (injection) of ACTH, usually into the muscle in your shoulder. The ACTH may be a man-made (synthetic) form.
- After either 30 minutes or 60 minutes, or both, depending on how much ACTH you receive, your blood is drawn again.
- The lab checks the cortisol level in all the blood samples.

You may also have other blood tests, including ACTH, as part of the first blood test. Along with the blood tests, you may also have a urine cortisol test or urine 17-ketosteroids test, which involves collecting the urine over a 24-hour period.

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

You may need to limit activities and eat foods that are high in carbohydrates 12 to 24 hours before the test. You may be asked to fast for 6 hours before the test. Sometimes, no special preparation is needed. You may be asked to temporarily stop taking medicines, such as hydrocortisone, which can interfere with the cortisol blood test.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away. The injection into the shoulder may cause moderate pain or stinging.

Some people feel flushed, nervous, or nauseated after the injection of ACTH.

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

This test can help determine whether your adrenal and pituitary glands are normal. It is most often used when your health care provider thinks you have an adrenal gland problem, such as Addison disease or pituitary insufficiency. It is also used to see if your pituitary and adrenal glands have recovered from prolonged use of glucocorticoid medicines, such as prednisone.

### **Normal Results**

An increase in cortisol after stimulation by ACTH is expected. Cortisol level after ACTH stimulation should be higher than 18 to 20 mcg/dL or 497 to 552 nmol/L, depending on the dose of ACTH used.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

This test is helpful in finding out if you have:

- Acute adrenal crisis (life-threatening condition that occurs when there is not enough cortisol)
- Addison disease (adrenal glands do not produce enough cortisol)
- Hypopituitarism (pituitary gland is not producing enough hormones such as ACTH)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins



- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Acute flaccid myelitis**

#### **Definition**

Acute flaccid myelitis is a rare condition that affects the nervous system. Inflammation of the gray matter in the spinal cord leads to muscle weakness and paralysis.

Acute flaccid myelitis (AFM) is usually caused by infection with a virus. While AFM is rare, there has been a slight increase in cases of AFM since 2014. Most new cases have occurred in children or young adults.

#### **Alternative Names**

Acute flaccid myelitis; AFM; Polio-like syndrome; Acute flaccid paralysis; Acute flaccid paralysis with anterior myelitis; Anterior myelitis; Enterovirus D68; Enterovirus A71

#### **Causes**

AFM usually occurs after a cold, fever, or gastrointestinal illness.

Different kinds of viruses may be the cause of AFM. These include:

- Enteroviruses (poliovirus and non-poliovirus)
- West Nile virus and similar viruses such as Japanese encephalitis virus and Saint Louis encephalitis virus
- Adenoviruses

It is unclear why certain viruses trigger AFM, or why some people develop the condition and others don't.

Environmental toxins also can cause AFM. In many cases, a cause is never found.

#### **Symptoms**

A fever or a respiratory illness is often present before weakness and other symptoms begin.

AFM symptoms often start with sudden muscle weakness and loss of reflexes in an arm or leg.

Symptoms may progress rapidly over a few hours to days. Other symptoms may include:

- Facial droop or weakness
- Drooping eyelids
- Difficulty moving the eyes
- Slurred speech or difficulty swallowing

Some people may have:

- Stiffness in the neck
- Pain in the arms or legs
- Inability to pass urine

Severe symptoms include:

- Respiratory failure, when muscles involved in breathing become weak
- Serious nervous system problems, which may lead to death

#### **Exams and Tests**

Your health care provider will take your medical history and vaccination history to know if you are up-to-date with your polio vaccines. Unvaccinated individuals who are exposed to poliovirus are at higher risk for acute flaccid myelitis. Your provider also may want to know if within the last 4 weeks you have:

- Traveled
- Had a cold or the flu or a stomach bug
- Had a fever 100°F (38°C) or higher

Your provider will do a physical exam. Tests that may be done include:

- MRI of spine and MRI of the brain to view lesions in the gray matter
- Nerve conduction velocity test
- Electromyography (EMG)
- Cerebrospinal fluid (CSF) analysis to check if white blood cells are elevated

Your provider also may take stool, blood, and saliva samples to test.

#### **Treatment**

There is no specific treatment for AFM. You may be referred to a doctor specializing in disorders of the nerves and nervous system (neurologist). The doctor will likely treat your symptoms.

A number of medicines and treatments that work on the immune system have been tried but have not been found to help.

You may need physical therapy to help restore muscle function.

### **Outlook (Prognosis)**

The long-term outlook of AFM is not known.

### **Possible Complications**

Complications of AFM include:

- Muscle weakness and paralysis
- Loss of limb function

### **When to Contact a Medical Professional**

Contact your provider right away if you or your child have:

- Sudden weakness in the arms or legs or difficulty moving the head or face
- Any other symptom of AFM

### **Prevention**

There is no clear way to prevent AFM. Having a polio vaccine may help reduce the risk of AFM related to the poliovirus.

Take these steps to help avoid viral infection:

- Wash hands frequently with soap and water, especially before eating.
- Avoid close contact with people who have a viral infection.
- Use mosquito repellants when going outdoors to prevent mosquito bites.

### **Alanine transaminase (ALT) blood test**

#### **Definition**

The alanine transaminase (ALT) blood test measures the level of the enzyme ALT in the blood.

#### **Alternative Names**

SGPT; Serum glutamate pyruvate transaminase; Alanine transaminase; Alanine aminotransferase

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

A blood sample is needed.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

ALT is an enzyme found in a high level in the liver. An enzyme is a protein that causes a specific chemical change in the body.

Injury to the liver results in release of ALT into the blood.

This test is mainly done along with other tests (such as AST, ALP, and bilirubin) to diagnose and monitor liver disease.

#### **Normal Results**

The normal range is 4 to 36 U/L.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

An increased ALT level is often a sign of liver disease. Liver disease is even more likely when the levels of substances checked by other liver blood tests have also increased.

An increased ALT level may be due to any of the following:

- Scarring of the liver (cirrhosis)
- Death of liver tissue
- Swollen and inflamed liver (hepatitis)
- Too much iron in the body (hemochromatosis)
- Too much fat in the liver (fatty liver)
- Lack of blood flow to the liver (liver ischemia)
- Liver tumor or cancer
- Use of drugs that are toxic to the liver

- Mononucleosis ("mono")
- Swollen and inflamed pancreas (pancreatitis)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood collecting under the skin)
- Infection (a slight risk any time the skin is broken)

### **Albumin blood (serum) test**

#### **Definition**

Albumin is a protein made by the liver. A serum albumin test measures the amount of this protein in the clear liquid portion of the blood.

Albumin can also be measured in the urine.

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

A blood sample is needed.

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

The health care provider may tell you to temporarily stop taking certain medicines that can affect the test. Drugs that can increase albumin levels include:

- Anabolic steroids
- Androgens
- Growth hormone
- Insulin

Do not stop taking any of your medicines without talking to your provider first.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Albumin helps move many small molecules through the blood, including bilirubin, calcium, progesterone, and medicines. It plays an important role in keeping the fluid in the blood from leaking into the tissues.

This test can help determine if you have liver disease or kidney disease, or if your body is not absorbing enough protein.

#### **Normal Results**

The normal range is 3.4 to 5.4 g/dL (34 to 54 g/L).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Lower-than-normal level of serum albumin may be a sign of:

- Kidney diseases
- Liver disease (for example, hepatitis, or cirrhosis that may cause ascites)

Decreased blood albumin may occur when your body does not get or absorb enough nutrients, such as with:

- After weight-loss surgery
- Crohn disease (inflammation of the digestive tract)
- Low-protein diets
- Celiac disease (damage of the lining of the small intestine due to eating gluten)
- Whipple disease (condition that prevents the small intestine from allowing nutrients to pass into the rest of the body)

Increased blood albumin may be due to:

- Dehydration

- High protein diet
- Having a tourniquet on for a long time when giving a blood sample

Drinking too much water (water intoxication) may also cause abnormal albumin results.

Other conditions for which the test may be performed:

- Burns (widespread)
- Wilson disease (condition in which there is too much copper in the body)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood collecting under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

If you are receiving large amounts of intravenous fluids, the results of this test may be inaccurate.

Albumin will be decreased during pregnancy.

### **Aldolase blood test**

#### **Definition**

Aldolase is a protein (called an enzyme) that helps break down certain sugars to produce energy. It is found in high amount in muscle and liver tissue.

A test can be done to measure the amount of aldolase in your blood.

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

A blood sample is needed.

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

You may be told not to eat or drink anything for 6 to 12 hours before the test. You may be also told to avoid vigorous exercise for 12 hours before the test. Your health care provider will tell you if it is necessary to stop taking any medicines that may interfere with this test. Tell your provider about all the medicines you are taking, both prescription and nonprescription.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is done to diagnose or monitor muscle or liver damage.

Other tests that may be ordered to check for liver damage include:

- ALT (alanine aminotransferase) test
- AST (aspartate aminotransferase) test

Other tests that may be ordered to check for muscle cell damage include:

- CPK (creatine phosphokinase) test
- LDH (lactate dehydrogenase) test

In some cases of inflammatory myositis, especially dermatomyositis, aldolase level may be elevated even when CPK is normal.

### **Normal Results**

Normal results range between 1.0 to 7.5 units per liter (0.02 to 0.13 microkat/L). There is a slight difference between men and women.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level may be due to:

- Damage to skeletal muscles
- Heart attack

- Liver, pancreatic, or prostate cancer
- Muscle disease such as dermatomyositis, muscular dystrophy, polymyositis
- Swelling and inflammation of the liver (hepatitis)
- Viral infection called mononucleosis

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Aldosterone blood test**

#### **Definition**

The aldosterone blood test measures the level of the hormone aldosterone in blood.

Aldosterone can also be measured using a urine test.

#### **Alternative Names**

Aldosterone - serum; Addison disease - serum aldosterone; Primary hyperaldosteronism - serum aldosterone; Bartter syndrome - serum aldosterone

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

A blood sample is needed.

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

Your health care provider may ask you to stop taking certain medicines a few days before the test so that they don't affect the test results. Be sure to tell your provider about all the medicines you take. These include:

- High blood pressure medicines
- Heart medicines
- Nonsteroidal anti-inflammatory drugs (NSAIDs)
- Antacid and ulcer medicines
- Water pills (diuretics)

Do not stop taking any medicine before talking to your doctor. Your provider may recommend that you eat no more than 3 grams of salt (sodium) per day for at least 2 weeks before the test.

Or, your provider will recommend that you eat your usual amount of salt and also test the amount of sodium in your urine.

At other times, the aldosterone blood test is done right before and after you receive a salt solution (saline) through the vein (IV) for 2 hours. Be aware that other factors can affect aldosterone measurements, including:

- Pregnancy
- High- or low-sodium diet
- High- or low-potassium diet
- Strenuous exercise
- Stress

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is ordered for the following conditions:

- Certain fluid and electrolyte disorders, most often low or high blood sodium or low potassium
- Hard to control blood pressure
- Low blood pressure upon standing (orthostatic hypotension)

Aldosterone is a hormone released by the adrenal glands. It helps the body regulate blood pressure. Aldosterone increases the reabsorption of sodium and water and the release of potassium in the kidneys. This action raises blood pressure.

Aldosterone blood test is often combined with other tests, such as the renin hormone test, to diagnose over- or under-production of aldosterone.

### **Normal Results**

Normal levels vary:

- Between children, teens, and adults
- Depending on whether you were standing, sitting, or lying down when the blood was drawn

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level of aldosterone may be due to:

- Bartter syndrome (group of rare conditions that affect the kidneys)
- Adrenal glands release too much aldosterone hormone (primary hyperaldosteronism - usually due to a benign nodule in the adrenal gland)
- Very low-sodium diet
- Taking blood pressure medicines called mineralocorticoid antagonists

A lower than normal level of aldosterone may be due to:

- Adrenal gland disorders, including not releasing enough aldosterone, and a condition called primary adrenal insufficiency (Addison disease)
- Very high-sodium diet

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one patient to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Allergy testing - skin**

#### **Definition**

Allergy skin tests are used to find out which substances cause a person to have an allergic reaction.

#### **Alternative Names**

Patch tests - allergy; Scratch tests - allergy; Skin tests - allergy; RAST test; Allergic rhinitis - allergy testing; Asthma - allergy testing; Eczema - allergy testing; Hayfever - allergy testing; Dermatitis - allergy testing; Allergy testing; Intradermal allergy testing

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

There are three common methods of allergy skin testing.

The skin prick test involves:

- Placing a small amount of substances that may be causing your symptoms on the skin, most often on the forearm, upper arm, or back.
- The skin is then pricked so the allergen goes under the skin's surface.
- The health care provider closely watches the skin for swelling and redness or other signs of a reaction. Results are usually seen within 15 to 20 minutes.
- Several allergens can be tested at the same time. Allergens are substances that cause an allergic reaction.

The intradermal skin test involves:

- Injecting a small amount of allergen into the skin.
- The provider then watches for a reaction at the site.



- This test is more likely to be used to find out if you're allergic to bee venom or penicillin. Or it may be used if the skin prick test was negative and the provider still thinks that you're allergic to the allergen.

Patch testing is a method to diagnose the cause of skin reactions that occur after the substance touches the skin:

- Possible allergens are taped to the skin for 48 hours.
- The provider will look at the area in 72 to 96 hours.

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

Before any allergy testing, the provider will ask about:

- Illnesses
- Where you live and work
- Lifestyle
- Foods and eating habits

Allergy medicines can change the results of skin tests. Your provider will tell you which medicines to avoid and when to stop taking them before the test.

### **How the Test will Feel**

Skin tests may cause very mild discomfort when the skin is pricked.

You may have symptoms such as itching, a stuffy nose, red watery eyes, or a skin rash if you're allergic to the substance in the test.

In rare cases, people can have a whole-body allergic reaction (called anaphylaxis), which can be life threatening. This usually only occurs with intradermal testing. Your provider will be prepared to treat this serious response.

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

Allergy tests are done to find out which substances are causing your allergy symptoms.

Your provider may order allergy skin tests if you have:

- Hay fever (allergic rhinitis) and asthma symptoms that are not well controlled with medicine
- Hives and angioedema
- Food allergies
- Skin rashes (dermatitis), in which the skin becomes red, sore, or swollen after contact with the substance
- Penicillin allergy
- Venom allergy

Allergies to penicillin and related medicines are the only drug allergies that can be tested using skin tests. Skin tests for allergies to other drugs can be dangerous.

The skin prick test may also be used to diagnose food allergies. Intradermal tests are not used to test for food allergies because of high false-positive results and the danger of causing a severe allergic reaction.

### **Normal Results**

A negative test result means there were no skin changes in response to the allergen. This negative reaction most often means that you are not allergic to the substance.

In rare cases, a person may have a negative allergy test and still be allergic to the substance.

### **What Abnormal Results Mean**

A positive result means you reacted to a substance. Your provider will see a red, raised area called a wheal.

Often, a positive result means the symptoms you're having are due to exposure to that substance. A stronger response means you are likely more sensitive to the substance.

People can have a positive response to a substance with allergy skin testing, but not have any problems with that substance in everyday life.

Skin tests are usually accurate. But, if the dose of allergen is large, even people who are not allergic will have a positive reaction.

Your provider will consider your symptoms and the results of your skin test to suggest lifestyle changes you can make to avoid substances that may be causing your symptoms.

### **ALP - blood test**

#### **Definition**

Alkaline phosphatase (ALP) is a protein found in all body tissues. Tissues with higher amounts of ALP include the liver, bile ducts, and bone.

A blood test can be done to measure the level of ALP.

A related test is the ALP isoenzyme test.

### **Alternative Names**

Alkaline phosphatase

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

You should not to eat or drink anything for 6 hours before the test, unless your health care provider tells you otherwise.

Many medicines can interfere with blood test results.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

This test may be done:

- To diagnose liver or bone disease
- To check, if treatments for those diseases are working
- As part of a routine liver function test

### **Normal Results**

The normal range is 44 to 147 international units per liter (IU/L) or 0.73 to 2.45 microkatal per liter (μkat/L).

Normal values may vary slightly from laboratory to laboratory. They also can vary with age and gender. High levels of ALP are normally seen in children undergoing growth spurts and in pregnant women.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Abnormal results may be due to the following conditions:

Higher-than-normal ALP levels

- Biliary obstruction
- Bone disease
- Eating a fatty meal if you have blood type O or B
- Healing fracture
- Hepatitis
- Hyperparathyroidism
- Leukemia
- Liver disease
- Lymphoma
- Osteoblastic bone tumors
- Osteomalacia
- Paget disease
- Rickets
- Sarcoidosis

Lower-than-normal ALP levels

- Hypophosphatasia
- Malnutrition
- Protein deficiency
- Wilson disease

Other conditions for which the test may be done:

- Alcoholic liver disease (hepatitis/cirrhosis)
- Alcoholism
- Biliary stricture
- Gallstones
- Giant cell (temporal, cranial) arteritis
- Multiple endocrine neoplasia (MEN) II
- Pancreatitis
- Renal cell carcinoma

## **ALP isoenzyme test**

### **Definition**

Alkaline phosphatase (ALP) is an enzyme found in many body tissues such as liver, bile ducts, bone, and intestine. There are several different forms of ALP called isoenzymes. The structure of the enzyme depends on where in the body it is produced. This test is most often used to test ALP made in the tissues of the liver and bones.

The ALP isoenzyme test is a lab test that measures the amounts of different types of ALP in the blood.

The ALP test is a related test.

### **Alternative Names**

Alkaline phosphatase isoenzyme test

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

You should not eat or drink anything for 10 to 12 hours before the test, unless your health care provider tells you to do so.

Many medicines can interfere with blood test results.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

When the ALP test result is high, you may need to have the ALP isoenzyme test. This test will help determine what part of the body is causing higher ALP levels.

This test may be used to diagnose or monitor:

- Bone disease
- Liver, gallbladder, or bile duct disease
- Pain in the abdomen
- Parathyroid gland disease
- Vitamin D deficiency

It may also be done to check liver function and to see how medicines you take may affect your liver.

### **Normal Results**

The normal value for total ALP is 44 to 147 international units per liter (IU/L) or 0.73 to 2.45 microkatal per liter ( $\mu$ kat/L). ALP isoenzyme testing may have differing normal values.

Adults have lower levels of ALP than children. Bones that are still growing produce higher levels of ALP. During some growth spurts, levels can be as high as 500 IU/L or 835  $\mu$ Kat/L. For this reason, the test is usually not done in children, and abnormal results refer to adults.

The isoenzyme test results can reveal whether the increase is in "bone" ALP or "liver" ALP.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurement range for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Higher-than-normal ALP levels:

- Biliary obstruction
- Bone disease
- Eating a fatty meal if you have blood type O or B
- Healing fracture
- Hepatitis
- Hyperparathyroidism
- Leukemia
- Liver disease
- Lymphoma
- Osteoblastic bone tumors
- Osteomalacia
- Paget disease
- Rickets
- Sarcoidosis

Lower-than-normal levels of ALP:

- Hypophosphatasia
- Malnutrition
- Protein deficiency
- Wilson disease

Levels that are only slightly higher than normal may not be a problem unless there are other signs of a disease or medical problem.

### **Alpha fetoprotein**

#### **Definition**

Alpha fetoprotein (AFP) is a protein produced by the liver and yolk sac of a developing baby during pregnancy. AFP levels go down soon after birth. It is likely that AFP has no normal function in adults.

A test can be done to measure the amount of AFP in your blood.

#### **Alternative Names**

Fetal alpha globulin; AFP

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

A blood sample is needed. Most of the time, blood is typically drawn from a vein located on the inside of the elbow or the back of the hand.

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

You do not need to take any special steps to prepare.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

Your health care provider may order this test to:

- Screen for problems in the baby during pregnancy. (The test is done as part of a larger set of blood tests called quadruple screen.)
- Diagnose certain liver disorders.
- Screen for and monitor some cancers.

#### **Normal Results**

The normal values in males or nonpregnant females is generally less than 40 micrograms/liter. The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Greater than normal levels of AFP may be due to:

- Cancer in testes, ovaries, biliary (liver secretion) tract, stomach, or pancreas
- Cirrhosis of the liver
- Liver cancer
- Malignant teratoma

- Recovery from hepatitis
- Problems during pregnancy

### **Alpha-1 antitrypsin blood test**

#### **Definition**

Alpha-1 antitrypsin (AAT) is a laboratory test to measure the amount of AAT in your blood. The test is also done to check for abnormal forms of AAT.

#### **Alternative Names**

A1AT test

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

A blood sample is needed.

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

There is no special preparation.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is helpful in identifying a rare form of emphysema in adults and a rare form of liver disease (cirrhosis) in children and adults caused by an AAT deficiency. AAT deficiency is passed down through families. The condition causes the liver to make too little of AAT, a protein that protects the lungs and liver from damage.

Everyone has two copies of the gene that makes AAT. Most people with a lower-than-normal level of AAT have one normal gene for AAT, and one abnormal gene. People with two abnormal copies of the gene have more severe disease.

#### **Normal Results**

Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

A lower-than-normal level of AAT may be associated with:

- Damage of the large airways in the lungs (bronchiectasis)
- Scarring of the liver (cirrhosis)
- Chronic obstructive pulmonary disease (COPD)
- Liver tumors
- Yellowing of the skin and eyes due to blocked bile flow (obstructive jaundice)
- High blood pressure in the large vein leads to the liver (portal hypertension)

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Aminoaciduria**

#### **Definition**

Aminoaciduria is an abnormal amount of amino acids in the urine. Amino acids are the building blocks for proteins in the body.

#### **Alternative Names**

Amino acids - urine; Urine amino acids

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

A clean-catch urine sample is needed. This is often done at your health care provider's office or health clinic.

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

Most of the time, you do not need to take special steps before this test. Make sure your provider knows all of the medicines you recently used. If this test is being done on an infant who is breastfeeding, make sure the provider knows what medicines the nursing mother is taking.

### **How the Test will Feel**

The test involves only normal urination.

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

This test is done to measure amino acid levels in the urine. There are many different types of amino acids. It is common for some of each kind to be found in the urine. Increased levels of individual amino acids can be a sign of a problem with metabolism.

### **Normal Results**

The specific value is measured in mmol/mol creatinine. The values below represent normal ranges in 24 hours urine for adults.

Alanine: 9 to 98

Arginine: 0 to 8

Asparagine: 10 to 65

Aspartic acid: 5 to 50

Citrulline: 1 to 22

Cystine: 2 to 12

Glutamic acid: 0 to 21

Glutamine: 11 to 42

Glycine: 17 to 146

Histidine: 49 to 413

Isoleucine: 30 to 186

Leucine: 1 to 9

Lysine: 2 to 16

Methionine: 2 to 53

Ornithine: 1 to 5

Phenylalanine: 1 to 5

Proline: 3 to 13

Serine: 0 to 9

Taurine: 18 to 89

Threonine: 13 to 587

Tyrosine: 3 to 14

Valine: 3 to 36

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Increased total urine amino acids may be due to:

- Alkaptonuria
- Canavan disease
- Cystinosis
- Cystathioninuria
- Fructose intolerance
- Galactosemia
- Hartnup disease
- Homocystinuria
- Hyperammonemia
- Hyperparathyroidism
- Maple syrup urine disease
- Methylmalonic acidemia
- Multiple myeloma
- Ornithine transcarbamylase deficiency
- Osteomalacia



- Propionic acidemia
- Rickets
- Tyrosinemia type 1
- Tyrosinemia type 2
- Viral hepatitis
- Wilson disease

### **Considerations**

Screening infants for increased levels of amino acids can help detect problems with metabolism. Early treatment for these conditions may prevent complications in the future.

### **Ammonia blood test**

#### **Definition**

The ammonia test measures the level of ammonia in a blood sample.

#### **Alternative Names**

Serum ammonia; Encephalopathy - ammonia; Cirrhosis - ammonia; Liver failure - ammonia

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

A blood sample is needed.

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

Your health care provider may ask you to stop taking certain drugs that may affect test results.

These include:

- Alcohol
- Acetazolamide
- Barbiturates
- Diuretics
- Narcotics
- Valproic acid

You should not smoke before your blood is drawn.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Ammonia (NH<sub>3</sub>) is produced by cells throughout the body, especially the intestines, liver, and kidneys. Most of the ammonia produced in the body is used by the liver to produce urea. Urea is also a waste product, but it is much less toxic than ammonia. Ammonia is especially toxic to the brain. It can cause confusion, low energy, and sometimes coma.

This test may be done if you have, or your provider thinks you have, a condition that may cause a toxic buildup of ammonia. It is most commonly used to diagnose and monitor hepatic encephalopathy, a severe liver disease.

#### **Normal Results**

The normal range is 15 to 45 µ/dL (11 to 32 µmol/L).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may mean you have increased ammonia levels in your blood. This may be due to any of the following:

- Gastrointestinal (GI) bleeding, usually in the upper GI tract
- Genetic diseases of the urea cycle
- High body temperature (hyperthermia)
- Kidney disease
- Liver failure
- Low blood potassium level (in people with liver disease)
- Parenteral nutrition (nutrition by vein)
- Reye syndrome
- Salicylate poisoning
- Severe muscle exertion

- Ureterosigmoidostomy (a procedure to reconstruct the urinary tract in certain illnesses)
- Urinary tract infection with a bacteria called *Proteus mirabilis*

A high-protein diet can also raise the blood ammonia level.

### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Amniocentesis**

#### **Definition**

Amniocentesis is a test that can be done during pregnancy to look for certain problems in the developing baby. These problems include:

- Birth defects
- Genetic problems
- Infection
- Lung development

#### **Alternative Names**

Culture - amniotic fluid; Culture - amniotic cells; Alpha-fetoprotein - amniocentesis

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

Amniocentesis removes a small amount of fluid from the sac around the baby in the womb (uterus). It is most often done in a doctor's office or medical center. You do not need to stay in the hospital.

You will have a pregnancy ultrasound first. This helps your health care provider see where the baby is in your womb.

Numbing medicine is then rubbed onto part of your belly. Sometimes, the medicine is given through a shot in the skin on the belly area. The skin is cleaned with a disinfecting liquid.

Your provider inserts a long, thin needle through your belly and into your womb. A small amount of fluid (about 4 teaspoons or 20 milliliters) is removed from the sac surrounding the baby. In most cases, the baby is watched by ultrasound during the procedure.

The fluid is sent to a laboratory. Testing may include:

- Genetic studies
- Measurement of alpha-fetoprotein (AFP) levels (a substance produced in the liver of the developing baby)
- Culture for infection

Results of genetic testing usually take about 2 weeks. Other test results come back in 1 to 3 days.

Sometimes amniocentesis is also used later in pregnancy to:

- Diagnose infection
- Check whether the baby's lungs are developed and ready for delivery
- Remove excess fluid from around the baby if there is too much amniotic fluid (polyhydramnios)

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

Your bladder may need to be full for the ultrasound. Check with your provider about this.

Before the test, blood may be taken to find out your blood type and Rh factor. You may get a shot of medicine called Rho(D) Immune Globulin (RhoGAM and other brands) if you are Rh negative.

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

Amniocentesis is usually offered to women who are at increased risk of having a child with birth defects. This includes women who:

- Will be 35 or older when they give birth
- Had a screening test that shows there may be a birth defect or other problem
- Have had babies with birth defects in other pregnancies

- Have a family history of genetic disorders

Genetic counseling is recommended before the procedure. This will allow you to:

- Learn about other prenatal tests
- Make an informed decision about options for prenatal diagnosis

This test:

- Is a diagnostic test, not a screening test
- Is highly accurate for diagnosing Down syndrome
- Is most often done between 15 to 20 weeks, but can be performed at any time between 15 to 40 weeks

Amniocentesis can be used to diagnose many different gene and chromosome problems in the baby, including:

- Anencephaly (when the baby is missing a large portion of the brain)
- Down syndrome
- Rare metabolic disorders that are passed down through families
- Other genetic problems, like trisomy 18
- Infections in the amniotic fluid

### **Normal Results**

A normal result means:

- No genetic or chromosome problems were found in your baby.
- Bilirubin and alpha-fetoprotein levels appear normal.
- No signs of infection were found.

Note: Amniocentesis typically is the most accurate test for genetic conditions and malformation, Although rare, a baby may still have genetic or other types of birth defects, even if amniocentesis results are normal.

### **What Abnormal Results Mean**

An abnormal result may mean your baby has:

- A gene or chromosome problem, such as Down syndrome
- Birth defects that involve the spine or brain, such as spina bifida

Talk to your provider about the meaning of your specific test results. Ask your provider:

- How the condition or defect may be treated during or after your pregnancy
- What special needs your child may have after birth
- What other options you have about maintaining or ending your pregnancy

### **Risks**

Risks are minimal, but may include:

- Infection or injury to the baby
- Miscarriage
- Leaking of amniotic fluid
- Vaginal bleeding

### **Amylase - blood**

#### **Definition**

Amylase is an enzyme that helps digest carbohydrates. It is made in the pancreas and the glands that make saliva. When the pancreas is diseased or inflamed, amylase releases into the blood.

A test can be done to measure the level of this enzyme in your blood.

Amylase may also be measured with an amylase urine test.

#### **Alternative Names**

Pancreatitis - blood amylase

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

A blood sample is taken from a vein.

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

No special preparation is needed. However, you should avoid alcohol before the test. The health care provider may ask you to stop taking drugs that may affect the test. DO NOT stop taking any medicines without first talking to your provider.

Drugs that can increase amylase measurements include:

- Asparaginase
- Aspirin

- Birth control pills
- Cholinergic medicines
- Ethacrynic acid
- Methyldopa
- Opiates (codeine, meperidine, and morphine)
- Thiazide diuretics

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted to draw blood. Afterward, there may be some throbbing.

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

This test is most often used to diagnose or monitor acute pancreatitis. It may also detect some digestive tract problems.

The test may also be done for the following conditions:

- Chronic pancreatitis
- Pancreatic pseudocyst

#### **Normal Results**

The normal range is 40 to 140 units per liter (U/L) or 0.38 to 1.42 microkat/L ( $\mu\text{kat/L}$ ).

Normal value ranges may vary slightly among different laboratories. Some laboratories use different measurement methods. Talk to your provider about the meaning of your test results.

#### **What Abnormal Results Mean**

Increased blood amylase level may occur due to:

- Acute pancreatitis
- Cancer of the pancreas, ovaries, or lungs
- Cholecystitis
- Gallbladder attack caused by disease
- Gastroenteritis (severe)
- Infection of the salivary glands (such as mumps) or a blockage
- Intestinal blockage
- Macroamylasemia
- Pancreatic or bile duct blockage
- Perforated ulcer
- Tubal pregnancy (may have burst open)

Decreased amylase level may occur due to:

- Cancer of the pancreas
- Damage to the pancreas with pancreatic scarring
- Kidney disease
- Toxemia of pregnancy

#### **Risks**

Slight risks from having blood drawn may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

#### **Amylase - urine**

##### **Definition**

This is a test that measures the amount of amylase in urine. Amylase is an enzyme that helps digest carbohydrates. It is produced mainly in the pancreas and the glands that make saliva.

Amylase may also be measured with a blood test.

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

A urine sample is needed. The test may be performed using:

- Clean-catch urine test
- 24-hour urine collection

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

Many medicines can interfere with test results.

- Your health care provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

#### **How the Test will Feel**

The test involves only normal urination. There is no discomfort.

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

This test is done to diagnose pancreatitis and other diseases that affect the pancreas.

#### **Normal Results**

The normal range is 2.6 to 21.2 international units per hour (IU/h).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurement range for results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

An increased amount of amylase in the urine is called amylasuria. Increased urine amylase levels may be a sign of:

- Acute pancreatitis
- Alcohol consumption
- Cancer of the pancreas, ovaries, or lungs
- Cholecystitis
- Ectopic or ruptured tubal pregnancy
- Gallbladder disease
- Infection of the salivary glands (called sialoadenitis, may be caused by bacteria, mumps or a blockage)
- Intestinal obstruction
- Pancreatic duct obstruction
- Pelvic inflammatory disease
- Perforated ulcer

Decreased amylase levels may be due to:

- Damage to the pancreas
- Kidney disease
- Macroamylasemia

### **Anoscopy**

#### **Definition**

Anoscopy is a method to look at the:

- Anus
- Anal canal
- Lower rectum

#### **Alternative Names**

Anal fissures - anoscopy; Anal polyps - anoscopy; Foreign object in the anus - anoscopy;

Hemorrhoids - anoscopy; Anal warts - anoscopy

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

The procedure is usually done in a doctor's office.

A digital rectal exam is done first. Then, a lubricated instrument called an anoscope is placed a few inches or centimeters into the rectum. You will feel some discomfort when this is done.

The anoscope has a light on the end, so your health care provider can see the entire area. A sample for biopsy can be taken, if needed.

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

Often, there is no preparation needed. Or, you may receive a laxative, enema, or other preparation to empty your bowel. You should empty your bladder before the procedure.

#### **How the Test will Feel**

There will be some discomfort during the procedure. You may feel the need to have a bowel movement. You may feel a pinch when a biopsy is taken.

You can usually return to normal activities after the procedure.

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

This test may be used to determine whether you have:

- Anal fissures (small split or tear in the lining of the anus)
- Anal polyps (growth on the lining of the anus)
- Foreign object in the anus
- Hemorrhoids (swollen veins in the anus)
- Infection
- Inflammation
- Tumors

#### **Normal Results**

The anal canal appears normal in size, color, and tone. There is no sign of:

- Bleeding
- Polyps
- Hemorrhoids
- Other abnormal tissue

#### **What Abnormal Results Mean**

Abnormal results may include:

- Abscess (collection of pus in the anus)
- Fissures
- Foreign object in the anus
- Hemorrhoids
- Infection
- Inflammation
- Polyps (non-cancerous or cancerous)
- Tumors

#### **Risks**

There are few risks. If a biopsy is needed, there is a slight risk of bleeding and mild pain.

#### **Anthrax blood test**

##### **Definition**

The anthrax blood test is used to measure substances (proteins) called antibodies, which are produced by the body in reaction to the bacteria that cause anthrax.

##### **Alternative Names**

Anthrax serology test; Antibody test for anthrax; Serologic test for B. anthracis

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

A blood sample is needed.

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

There is no special preparation.

##### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test may be performed when the health care provider suspects you have anthrax infection. The bacteria that cause anthrax is called *Bacillus anthracis*.

##### **Normal Results**

A normal result means no antibodies to the anthrax bacteria were seen in your blood sample. However, during the early stages of infection, your body may only produce a few antibodies, which the blood test may miss. The test may need to be repeated in 10 days to 2 weeks. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

##### **What Abnormal Results Mean**

An abnormal result means antibodies to the bacteria have been detected and you may have anthrax disease. But, some people come in contact with the bacteria and do not develop the disease. To determine if you have a current infection, your provider will look for an increase in the antibody count after a few weeks as well as your symptoms and physical exam findings.

##### **Risks**



There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

The best test for diagnosing anthrax is a culture of affected tissue or blood.

### **Antibody titer blood test**

#### **Definition**

Antibody titer is a laboratory test that measures the level of antibodies in a blood sample.

#### **Alternative Names**

Titer - antibodies; Serum antibodies

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

A blood sample is needed.

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

No special preparation is necessary for this test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

The antibody level (titer) in the blood tells your health care provider whether or not you have been exposed to an antigen, or something that the body thinks is foreign. The body uses antibodies to attack and remove foreign substances.

In some situations, your provider may check your antibody titer to see if you had an infection in the past (for example, chickenpox) or to decide which vaccines you need.

The antibody titer is also used to determine:

- The strength of an immune response to the body's own tissue in diseases such as systemic lupus erythematosus (SLE) and other autoimmune disorders
- If you need a booster vaccine
- Whether a vaccine you had before helped your immune system protect you against the specific disease
- If you have had a recent or past infection, such as mononucleosis or viral hepatitis

### **Normal Results**

Normal values depend on the antibody being tested.

If the test is being done to look for antibodies against your own body tissues, the normal value would be zero or negative. In some cases, a normal level is below a specific number.

If the test is being done to see if a vaccine fully protects you against a disease, the normal result depends on the specific value for that immunization.

Negative antibody tests can help rule out certain infections.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal results depend on which antibodies are being measured.

Abnormal results may be due to:

- Autoimmune disease
- Failure of a vaccine to fully protect you against a certain disease
- Immune deficiency
- Viral infections

### **Risks**

There is little risk involved with having your blood taken. Veins vary in size from one person 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.

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Antidiuretic hormone blood test**

#### **Definition**

Antidiuretic blood test measures the level of antidiuretic hormone (ADH) in blood.

#### **Alternative Names**

Arginine vasopressin; Antidiuretic hormone; AVP; Vasopressin

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

A blood sample is needed.

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

Talk to your health care provider about your medicines before the test. Many drugs can affect ADH level, including:

- Alcohol
- Diuretics (water pills)
- Blood pressure medicines
- Insulin
- Medicines for mental disorders
- Nicotine
- Steroids

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

ADH is a hormone that is produced in a part of the brain called the hypothalamus. It is then stored and released from the pituitary, a small gland at the base of the brain. ADH acts on the kidneys to control the amount of water excreted in the urine.

ADH blood test is ordered when your provider suspects you have a disorder that affects your ADH level such as:

- Buildup of fluids in your body that are causing swelling or puffiness (edema)
- Excessive amounts of urine
- Low sodium (salt) level in your blood
- Thirst that is intense or uncontrollable

Certain diseases affect the normal release of ADH. The blood level of ADH must be tested to determine the cause of the disease. ADH may be measured as part of a water restriction test to find the cause of a disease.

#### **Normal Results**

Normal values for ADH can range from 1 to 5 pg/mL (0.9 to 4.6 pmol/L).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

A higher-than-normal level may occur when too much ADH is released, either from the brain where it is made, or from somewhere else in the body. This is called syndrome of inappropriate ADH (SIADH).

Causes of SIADH include:

- Brain injury or trauma
- Brain tumors
- Fluid imbalance after surgery

- Infection in the brain or the tissue that surrounds the brain
- Infection in the lungs
- Certain medicines, such as some seizure drugs, pain medicines, and antidepressants
- Small cell carcinoma lung cancer
- Stroke

A higher-than-normal level of ADH may be found in people with heart failure, liver failure, or some kinds of kidney disease.

A lower-than-normal level may indicate:

- Damage to the hypothalamus or pituitary gland
- Central diabetes insipidus (condition in which the kidneys are not able to conserve water)
- Excessive thirst (polydipsia)
- Too much fluid in the blood vessels (volume overload)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Anti-DNase B blood test**

#### **Definition**

Anti-DNase B is a blood test to look for antibodies to a substance (protein) produced by group A streptococcus. This is the bacteria that cause strep throat.

When used together with the ASLO titer test, more than 90% of past streptococcal infections can be correctly identified.

#### **Alternative Names**

Strep throat - anti-DNase B test; Antideoxyribonuclease B titer; ADN-B test

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

A blood sample is needed.

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is most often done to tell if you have previously had a strep infection and if you might have rheumatic fever or kidney problems (glomerulonephritis) due to that infection.

#### **Normal Results**

A negative test is normal. Some people have low concentrations of antibodies, but they have not had a recent strep infection. Therefore, normal values in different age groups are:

- Adults: less than 85 units/milliliter (mL)
- School-age children: less than 170 units/mL
- Preschool children: less than 60 units/mL

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different specimens. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Increased levels of DNase B levels indicate exposure to group A streptococcus.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Other risks:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Anti-glomerular basement membrane blood test**

#### **Definition**

The glomerular basement membrane is the part of the kidney that helps filter waste and extra fluid from the blood.

Anti-glomerular basement membrane antibodies are antibodies against this membrane. They can lead to kidney damage. This article describes the blood test to detect these antibodies.

#### **Alternative Names**

GBM antibody test; Antibody to human glomerular basement membrane; Anti-GBM antibodies

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

A blood sample is needed.

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is used to diagnose certain kidney diseases, such as Goodpasture syndrome and anti-glomerular basement membrane disease.

#### **Normal Results**

Normally, there are none of these antibodies in the blood. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Antibodies in the blood may mean any of the following:

- Anti-glomerular basement membrane disease
- Goodpasture syndrome

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Other risks:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Anti-insulin antibody test**

#### **Definition**

The anti-insulin antibody test checks to see if your body has produced antibodies against insulin.

Antibodies are proteins the body produces to protect itself when it detects anything "foreign," such as a virus or transplanted organ.

#### **Alternative Names**

Insulin antibodies - serum; Insulin Ab test; Insulin resistance - insulin antibodies; Diabetes - insulin antibodies

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

A blood sample is needed.

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

No special preparation is needed.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test may be performed if:

- You have or are at risk for type 1 diabetes.
- You appear to have an allergic response to insulin.
- Insulin no longer seems to control your diabetes.
- You are taking insulin to control your diabetes and your blood sugar level varies a lot, with both high and low numbers that can't be explained by the food you are eating relative to the timing of your insulin injections.

### **Normal Results**

Normally, there are no antibodies against insulin in your blood. Antibodies can be found in the blood of many people who are taking insulin to control diabetes.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

If you have IgG and IgM antibodies against insulin, your body reacts as if the insulin in your body is a foreign protein that needs to be removed. This result can be part of the testing that diagnoses you with autoimmune or type 1 diabetes.

If you have diabetes and develop anti-insulin antibodies, this may make insulin less effective, or not effective at all.

This is because the antibody prevents the insulin from working the right way in your cells. As a result, your blood sugar can be unusually high. Many people who are taking insulin to treat their diabetes have detectable antibodies. However, these antibodies do not cause symptoms or change the effectiveness of insulin.

The antibodies can also prolong the effect of insulin by releasing some insulin long after your meal has been absorbed. This can put you at risk for low blood sugar.

If the test shows a high level of IgE antibody against insulin, your body has developed an allergic response to the insulin. This could put you at risk for skin reactions where you inject insulin. You can also develop more severe reactions that affect your blood pressure or breathing.

Other medicines, such as antihistamines or low-dose injectable steroids, may help to lessen the reaction. If reactions have been severe, you may need a treatment process called desensitization or another treatment to remove the antibodies from your blood.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 of having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood building up under the skin)
- Infection (a slight risk any time the skin is broken)

### **Antimitochondrial antibody**

#### **Definition**

Antimitochondrial antibodies (AMA) are substances (antibodies) that form against mitochondria. The mitochondria are an important part of cells. They are the energy source inside the cells. These help the cells work properly.

This article discusses the blood test used to measure the amount of AMA in the blood.

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

A blood sample is needed. It is most often taken from a vein. The procedure is called a venipuncture.

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

Your health care provider may tell you not to eat or drink anything for up to 6 hours before the test (most often overnight).

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

You may need this test if you have signs of liver damage. This test is most often used to diagnose primary biliary cholangitis, formerly called primary biliary cirrhosis (PBC).

The test may also be used to tell the difference between bile system-related cirrhosis and liver problems due to other causes such as a blockage, viral hepatitis, or alcoholic cirrhosis.

### **Normal Results**

Normally, there are no antibodies present.

### **What Abnormal Results Mean**

This test is important for diagnosing PBC. Almost all people with the condition will test positive.

It is rare that a person without the condition will have a positive result. However, some people with a positive test for AMA and no other sign of liver disease may progress to PBC over time.

Rarely, abnormal results may also be found that are due to other kinds of liver disease and some autoimmune diseases.

### **Risks**

Risks for having blood drawn are slight but can include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Antinuclear antibody panel**

### **Definition**

The antinuclear antibody panel is a blood test that looks at antinuclear antibodies (ANA).

ANA are antibodies produced by the immune system that bind to the body's own tissues. The antinuclear antibody test looks for antibodies that bind to a part of the cell called the nucleus. The screening test determines whether such antibodies are present. The test also measures the level, called the titer, and the pattern, which can be helpful. If the test is positive, a panel of tests may be done to identify specific antigen targets. This is the ANA antibody panel.

### **Alternative Names**

ANA; ANA panel; ANA reflexive panel; SLE - ANA; Systemic lupus erythematosus - ANA

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

Blood is drawn from a vein. Most often, a vein on the inside of the elbow or the back of the hand is used. The site is cleaned with germ-killing medicine (antiseptic). The health care provider wraps an elastic band around the upper arm to apply pressure to the area and make the vein swell with blood.

Next, the provider gently inserts a needle into the vein. The blood collects into an airtight vial or tube attached to the needle. The elastic band is removed from your arm.

Once the blood has been collected, the needle is removed, and the puncture site is covered to stop any bleeding.

In infants or young children, a sharp tool called a lancet may be used to puncture the skin and make it bleed. The blood collects into a small glass tube called a pipette, or onto a slide or test strip. A bandage may be placed over the area if there is any bleeding.

Depending on the laboratory, the test may be processed in different ways. One method requires a technician to examine a blood sample under a microscope using ultraviolet light. The other uses an automated instrument to record the results.

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



No special preparation is needed. However, certain drugs, including birth control pills, procainamide, and thiazide diuretics, affect the accuracy of this test. Make sure your provider knows about all the medicines you take.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

You may need this test if you have signs of an autoimmune disorder, particularly systemic lupus erythematosus. This test may be done if you have unexplained symptoms such as arthritis, rashes, or chest pain.

### **Normal Results**

Some normal people have a low level of ANA. Thus, the presence of a low level of ANA is not always abnormal.

ANA is reported as a "titer". Low titers are in the range of 1:40 to 1:60. A positive ANA test is of much more importance if you also have antibodies against the double-stranded form of DNA.

The presence of ANA does not confirm a diagnosis of systemic lupus erythematosus (SLE).

However, a lack of ANA makes that diagnosis much less likely.

Although ANA are most often identified with SLE, a positive ANA test can also be a sign of other autoimmune diseases.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

Further tests can be run on blood with a positive ANA test to get more information.

### **What Abnormal Results Mean**

To make the diagnosis of SLE, certain clinical features as well as ANA must be present. In addition, certain specific ANA antibodies help to confirm the diagnosis.

The presence of ANA in the blood may be due to many other disorders besides SLE. These include:

#### **AUTOIMMUNE DISEASES**

- Mixed connective tissue disease
- Drug-induced lupus erythematosus
- Myositis (inflammatory muscle disease)
- Rheumatoid arthritis
- Sjögren syndrome
- Systemic sclerosis (scleroderma)
- Thyroid disease
- Autoimmune hepatitis
- Lymphomas

#### **INFECTIONS**

- EB virus
- Hepatitis C
- HIV
- Parvovirus

### **Risks**

Veins and arteries vary in size from one person to another, and from one side of the body to the other. Obtaining blood 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 lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

Your provider will use the results of the ANA panel to help make a diagnosis. Almost all people with active SLE have a positive ANA. However, a positive ANA by itself is not enough to make a

diagnosis of SLE or any other autoimmune disease. The ANA tests must be used along with your medical history, physical exam and other laboratory tests.

The ANA can be positive in relatives of people with SLE who do not have SLE themselves.

There is a very low chance of developing SLE at some time later in life if the only finding is a low titer of ANA.

### **Antiparietal cell antibody test**

#### **Definition**

An antiparietal cell antibody test is a blood test that looks for antibodies against the parietal cells of the stomach. The parietal cells make and release a substance that the body needs to absorb vitamin B12.

#### **Alternative Names**

APCA; Anti-gastric parietal cell antibody; Atrophic gastritis - anti-gastric parietal cell antibody; Gastric ulcer - anti-gastric parietal cell antibody; Pernicious anemia - anti-gastric parietal cell antibody; Vitamin B12 - anti-gastric parietal cell antibody

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

A blood sample is needed.

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Your health care provider may use this test to help diagnose pernicious anemia. Pernicious anemia is a decrease in red blood cells that occurs when your intestines cannot properly absorb vitamin B12. Other tests are also used to help with the diagnosis.

#### **Normal Results**

A normal result is called a negative result.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

An abnormal result is called a positive result. This may be due to:

- Atrophic gastritis (inflammation of the stomach lining)
- Diabetes
- Gastric ulcer
- Pernicious anemia
- Thyroid disease

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

### **Anti-smooth muscle antibody**

#### **Definition**

Anti-smooth muscle antibody is a blood test that detects the presence of antibodies against smooth muscle. The antibody is useful in making a diagnosis of autoimmune hepatitis.

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

A blood sample is needed. This may be taken through a vein. The procedure is called a venipuncture.

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

No special steps are needed to prepare for this test.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

You may need this test if you have signs of certain liver diseases, such as hepatitis and cirrhosis.

These conditions can trigger the body to form antibodies against smooth muscle.

Anti-smooth muscle antibodies are not often seen in diseases other than autoimmune hepatitis.

Therefore, it is helpful to make the diagnosis. Autoimmune hepatitis is treated with immunosuppressive medicines. People with autoimmune hepatitis often have other autoantibodies.

These include:

- Antinuclear antibodies.
- Anti-actin antibodies.
- Anti-soluble liver antigen/liver pancreas (anti-SLA/LP) antibodies.
- Other antibodies may be present, even when the anti-smooth muscle antibodies are absent.

The diagnosis and management of autoimmune hepatitis may require a liver biopsy.

### **Normal Results**

Normally, there are no antibodies present.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A positive test may be due to:

- Chronic active autoimmune hepatitis
- Cirrhosis
- Infectious mononucleosis

The test also helps distinguish autoimmune hepatitis from systemic lupus erythematosus.

### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Antistreptolysin O titer**

### **Definition**

Antistreptolysin O (ASO) titer is a blood test to measure antibodies against streptolysin O, a substance produced by group A streptococcus bacteria. Antibodies are proteins our bodies produce when they detect harmful substances, such as bacteria.

### **Alternative Names**

ASO titer; ASLO

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

A blood sample is needed.

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

DO NOT eat for 6 hours before the test.

### **How the Test will Feel**

When the needle is inserted to draw blood, you may feel moderate pain, or only a prick. After the test, you may have some throbbing at the site.

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

You will need the test if you have symptoms of a previous infection by group A streptococcus.

Some illnesses caused by these bacteria are:

- Bacterial endocarditis, an infection of the inner lining of your heart
- A kidney problem called glomerulonephritis
- Rheumatic fever, which can affect the heart, joints, or bones
- Scarlet fever
- Strep throat

The ASO antibody may be found in the blood weeks or months after the strep infection has gone away.

**Normal Results**

A negative test result means that you do not have strep infection. Your health care provider may do the test again in 2 to 4 weeks. At times, a test that was negative the first time may be positive (meaning it finds ASO antibodies) when done again.

Normal value ranges may vary slightly. Talk to your provider about the meaning of your test results.

**What Abnormal Results Mean**

An abnormal or positive test result means you recently had a strep infection, even if you had no symptoms.

**Risks**

Veins and arteries vary in size from person to person, and from one side of the body to the other. Because of this, it may be harder to get a blood sample from some people than it is from others. Other risks associated with having blood drawn are slight, but may include:

- Excessive bleeding where the needle is inserted
- Fainting or feeling lightheaded
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

**Antithrombin III blood test****Definition**

Antithrombin III (AT III) is a protein that helps control blood clotting. A blood test can determine the amount of AT III present in your body.

**Alternative Names**

Antithrombin; AT III; AT 3; Functional antithrombin III; Clotting disorder - AT III; DVT - AT III; Deep vein thrombosis - AT III

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

Certain medicines may affect the results of the test. Your health care provider may tell you to stop taking certain medicines or reduce their dose before the test. Do not stop taking any medicine before speaking with your provider.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

Your provider may order this test if you have repeated blood clots or if blood thinning medicine does not work.

**Normal Results**

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

**What Abnormal Results Mean**

Lower-than-normal AT III may mean you have an increased risk for blood clotting. This can occur when there is not enough AT III in your blood, or when there is enough AT III in your blood, but the AT III does not function properly and is less active.

Abnormal results may not appear until you are an adult.

Examples of complications associated with increased blood clotting are:

- Deep venous thrombosis
- Phlebitis (vein inflammation)
- Pulmonary embolus (blood clot traveling to lung)
- Thrombophlebitis (vein inflammation with clot formation)

Lower than normal AT III may be due to:

- Bone marrow transplant
- Disseminated intravascular coagulation (DIC)
- AT III deficiency, an inherited condition

- Liver cirrhosis
- Nephrotic syndrome

Higher than normal AT III may be due to:

- Use of anabolic steroids
- Bleeding disorder (hemophilia)
- Kidney transplant
- Low level of vitamin K

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Aortic angiography**

#### **Definition**

Aortic angiography is a procedure that uses a special dye and x-rays to see how blood flows through the aorta. The aorta is the major artery. It carries blood out of the heart, and through your abdomen or belly.

Angiography uses x-rays and a special dye to see inside the arteries. Arteries are blood vessels that carry blood away from the heart.

#### **Alternative Names**

Angiography - aorta; Aortography; Abdominal aorta angiogram; Aortic arteriogram; Aneurysm - aortic arteriogram

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

This test is done at a hospital. Before the test starts, you will be given a mild sedative to help you relax.

- An area of your body, most often in your arm or groin area, is cleaned and numbed with a local numbing medicine (anesthetic).
- A radiologist or cardiologist will place a needle into the groin blood vessel. A guidewire and a long tube (catheter) will be passed through this needle.
- The catheter is moved into the aorta. The doctor can see live images of the aorta on a TV-like monitor. X-rays are used to guide the catheter to the correct position.
- Once the catheter is in place, dye is injected into it. X-ray images are taken to see how the dye moves through the aorta. The dye helps detect any blockages in blood flow.

After the x-rays or treatments are finished, the catheter is removed. Pressure is applied to the puncture site for 20 to 45 minutes to stop the bleeding. After that time, the area is checked and a tight bandage is applied. The leg is most often kept straight for another 6 hours after the procedure.

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

You may be asked not to eat or drink anything for 6 to 8 hours before the test.

You will wear a hospital gown and sign a consent form for the procedure. Remove jewelry from the area being studied.

Tell your health care provider:

- If you are pregnant
- If you have ever had any allergic reactions to x-ray contrast material, shellfish, or iodine substances
- If you are allergic to any medicines
- Which medicines you are taking (including any herbal preparations)
- If you have ever had any bleeding problems

You will be awake during the test. You may feel a sting as the numbing medicine is given and some pressure as the catheter is inserted. You may feel a warm flushing when the contrast dye flows through the catheter. This is normal and most often goes away in a few seconds.

You may have some discomfort from lying on the hospital table and staying still for a long time. In most cases, you can resume normal activity the day after the procedure.

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

Your provider may ask for this test if there are signs or symptoms of a problem with the aorta or its branches, including:

- Aortic aneurysm
- Aortic dissection
- Congenital (present from birth) problems
- AV malformation
- Double aortic arch
- Coarctation of the aorta
- Vascular ring
- Injury to the aorta
- Takayasu arteritis

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Abdominal aortic aneurysm
- Aortic dissection
- Aortic regurgitation
- Congenital (present from birth) problems
- Double aortic arch
- Coarctation of the aorta
- Vascular ring
- Injury to the aorta
- Mesenteric ischemia
- Peripheral artery disease
- Renal artery stenosis
- Takayasu arteritis

### **Risks**

Risks for aortic angiography include:

- Allergic reaction to the contrast dye
- Blockage of the artery
- Blood clot that travels to the lungs
- Bruising at the site of catheter insertion
- Damage to the blood vessel where the needle and catheter are inserted
- Excessive bleeding or a blood clot where the catheter is inserted, which can reduce blood flow to the leg
- Heart attack or stroke
- Hematoma, a collection of blood at the site of the needle puncture
- Infection
- Injury to the nerves at the needle puncture site
- Kidney damage from the dye

### **Considerations**

This procedure may be done with left heart catheterization to look for coronary artery disease. Aortic angiography has been mostly replaced by computed tomography (CT) angiography or magnetic resonance (MR) angiography.

### **Apgar score**

#### **Definition**

Apgar is a quick test performed on a baby at 1 and 5 minutes after birth. The 1-minute score determines how well the baby tolerated the birthing process. The 5-minute score tells the health care provider how well the baby is doing outside the mother's womb.

In rare cases, the test will be done 10 minutes after birth.

Virginia Apgar, MD (1909-1974) introduced the Apgar score in 1952.

#### **Alternative Names**

Newborn scoring; Delivery - Apgar



### How the Test is Performed

The Apgar test is done by a doctor, midwife, or nurse. The provider examines the baby's:

- Breathing effort
- Heart rate
- Muscle tone
- Reflexes
- Skin color

Each category is scored with 0, 1, or 2, depending on the observed condition.

Breathing effort:

- If the infant is not breathing, the respiratory score is 0.
- If the respirations are slow or irregular, the infant scores 1 for respiratory effort.
- If the infant cries well, the respiratory score is 2.

Heart rate is evaluated by stethoscope. This is the most important assessment:

- If there is no heartbeat, the infant scores 0 for heart rate.
- If heart rate is less than 100 beats per minute, the infant scores 1 for heart rate.
- If heart rate is greater than 100 beats per minute, the infant scores 2 for heart rate.

Muscle tone:

- If muscles are loose and floppy, the infant scores 0 for muscle tone.
- If there is some muscle tone, the infant scores 1.
- If there is active motion, the infant scores 2 for muscle tone.

Grimace response or reflex irritability is a term describing response to stimulation, such as a mild pinch:

- If there is no reaction, the infant scores 0 for reflex irritability.
- If there is grimacing, the infant scores 1 for reflex irritability.
- If there is grimacing and a cough, sneeze, or vigorous cry, the infant scores 2 for reflex irritability.

Skin color:

- If the skin color is pale blue, the infant scores 0 for color.
- If the body is pink and the extremities are blue, the infant scores 1 for color.
- If the entire body is pink, the infant scores 2 for color.

### Why the Test is Performed

This test is done to determine whether a newborn needs help breathing or is having heart trouble.

#### Normal Results

The Apgar score is based on a total score of 1 to 10. The higher the score, the better the baby is doing after birth.

A score of 7, 8, or 9 is normal and is a sign that the newborn is in good health. A score of 10 is very unusual, since almost all newborns lose 1 point for blue hands and feet, which is normal for after birth.

#### What Abnormal Results Mean

Any score lower than 7 is a sign that the baby needs medical attention. The lower the score, the more help the baby needs to adjust outside the mother's womb.

Most of the time a low Apgar score is caused by:

- Difficult birth
- C-section
- Fluid in the baby's airway

A baby with a low Apgar score may need:

- Oxygen and clearing out the airway to help with breathing
- Physical stimulation to get the heart beating at a healthy rate

Most of the time, a low score at 1 minute is near-normal by 5 minutes.

A lower Apgar score does not mean a child will have serious or long-term health problems. The Apgar score is not designed to predict the future health of the child.

### Apolipoprotein B100

#### Definition

Apolipoprotein B100 (apoB100) is a protein that plays a role in moving cholesterol around your body. It is a form of low density lipoprotein (LDL).

Mutations (changes) in apoB100 can cause a condition called familial hypercholesterolemia. This is a form of high cholesterol that is passed down in families (inherited).

This article discusses the test used to measure the level of apoB100 in the blood.

**Alternative Names**

ApoB100; Apoprotein B100; Hypercholesterolemia - apolipoprotein B100

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

Your health care provider may tell you not to eat or drink anything for 4 to 6 hours before the test.

**How the Test will Feel**

When the needle is inserted to draw blood, you may feel moderate pain, or only a prick or stinging sensation. Afterward, there may be some throbbing.

**Why the Test is Performed**

Most often, this test is done to help determine the cause or specific type of high blood cholesterol. It is not clear whether the information helps improve treatment. Because of this, most health insurance companies DO NOT pay for the test. If you DO NOT have a diagnosis of high cholesterol or heart disease, this test may not be recommended for you.

**Normal Results**

The normal range is about 50 to 150 mg/dL.

Normal value ranges may vary slightly among different laboratories. Some laboratories use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

**What Abnormal Results Mean**

An abnormal result may mean you have high lipid (fat) levels in your blood. A medical term for this is hyperlipidemia.

Other disorders that may be associated with high apoB100 levels include atherosclerotic vascular disease such as angina pectoris (chest pain that occurs with activity or stress) and heart attack.

**Risks**

Risks linked with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)
- Multiple punctures to locate veins

**Considerations**

Apolipoprotein measurements may provide more detail about your risk for heart disease, but the added value of this test beyond a lipid panel is unknown.

**Apolipoprotein CII****Definition**

Apolipoprotein CII (apoCII) is a protein found in large fat particles that the gastrointestinal tract absorbs. It is also found in very low density lipoprotein (VLDL), which is made up of mostly triglycerides (a type of fat in your blood).

This article discusses the test used to check for apoCII in a sample of your blood.

**Alternative Names**

ApoCII; Apoprotein CII; ApoC2; Lipoprotein lipase deficiency - apolipoprotein CII; Chylomicronemia syndrome - apolipoprotein CII

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

You may be told not to eat or drink anything for 4 to 6 hours before the test.

**How the Test will Feel**

When the needle is inserted to draw blood, you may feel some pain, or only a prick or stinging. Afterward, there may be some throbbing where the needle was inserted.

**Why the Test is Performed**

ApoCII measurements can help determine the type or cause of high blood fats. It is not clear whether the test results improve treatment. Because of this, most health insurance companies will not pay for the test. If you DO NOT have high cholesterol or heart disease or a family history of these conditions, this test may not be recommended for you.

### **Normal Results**

The normal range is 3 to 5 mg/dL. However, apoCII results are usually reported as present or absent.

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

High levels of apoCII may be due to a family history of lipoprotein lipase deficiency. This is a condition in which the body does not break down fats normally.

ApoCII levels are also seen in people with a rare condition called familial apoprotein CII deficiency. This causes chylomicronemia syndrome, another condition in which the body does not break down fats normally.

### **Risks**

Risks associated with having blood drawn are slight but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

Apolipoprotein measurements may provide more detail about your risk for heart disease, but the added value of this test beyond a lipid panel is unknown.

### **Arm CT scan**

#### **Definition**

A computed tomography (CT) scan of the arm is an imaging method that uses x-rays to make cross-sectional pictures of the arm.

#### **Alternative Names**

CAT scan - arm; Computed axial tomography scan - arm; Computed tomography scan - arm; CT scan - arm

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

You will be asked to lie on a narrow table that slides into the center of the CT scanner.

Once you are inside the scanner, the machine's x-ray beam rotates around you. (Modern "spiral" scanners can perform the exam without stopping.)

A computer creates separate images of the arm area, called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the arm can be created by adding the slices together.

You must be still during the exam. Movement can cause blurred images. You may be told to hold your breath for short periods of time.

The scan should take only 10 to 15 minutes.

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

For some tests, you will need to have a special dye, called contrast, to be delivered into the body before the test starts. Contrast helps certain areas show up better on the x-rays.

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.
- Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test in order to safely receive this substance.
- Before receiving the contrast, tell your provider if you take the diabetes drug metformin (Glucophage). You may need to take special steps if you are on this medicine.

If you weigh more than 300 pounds (135 kilograms), find out if the CT machine has a weight limit. Too much weight can cause damage to the scanner's working parts.

You will be asked to remove jewelry and wear a hospital gown during the study.

#### **How the Test will Feel**

Some people may have discomfort from lying on the hard table.

Contrast given through an IV may cause a slight burning sensation, a metallic taste in the mouth, and a warm flushing of the body. These feels are normal. They will go away within a few seconds.

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

CT rapidly creates detailed pictures of the body, including the arms. The test may help detect or diagnose:

- An abscess or infection
- The cause of pain or other problems in the wrist, shoulder or elbow joints (usually when MRI cannot be done)
- A broken bone
- Masses and tumors, including cancer
- Healing problems or scar tissue following surgery

A CT scan may also be used to guide a surgeon to the right area during a biopsy.

### **Normal Results**

Results are considered normal if no problems are seen in the images.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Degenerative changes due to age
- Abscess (collection of pus)
- Blood clot in the arm (deep venous thrombosis)
- Bone tumors
- Cancer
- Broken or fractured bone
- Damage to the hand, wrist, or elbow joints
- Cyst
- Healing problems or development of scar tissue after surgery

### **Risks**

Risks of CT scans include:

- Being exposed to radiation
- Allergic reaction to contrast dye
- Birth defect if done during pregnancy

CT scans expose you to more radiation than regular x-rays. Having many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. You and your provider should weigh this risk against the benefits of getting a correct diagnosis for a medical problem.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast given into a vein contains iodine. A person with an iodine allergy may have nausea or vomiting, sneezing, itching, or hives if given this type of contrast.
- If contrast is needed, you may get antihistamines (such as Benadryl) or steroids before the test.
- The kidneys help remove iodine out of the body. Those with kidney disease or diabetes may need to get extra fluids after the test to help flush the iodine out of the body.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. If you have any trouble breathing during the test, let the scanner operator know right away. Scanners have intercom and speakers so the operator can hear you at all times.

### **Arm MRI scan**

#### **Definition**

An arm MRI (magnetic resonance imaging) scan uses strong magnets to create pictures of the upper and lower arm. This may include the elbow, wrist, hands, fingers, and the surrounding muscles and other tissues.

It does not use radiation (x-rays).

Single MRI images are called slices. The images can be stored on a computer or printed on film. One exam produces many images.

**Alternative Names**

MRI - arm; Wrist MRI; MRI - wrist; Elbow MRI; MRI - elbow

**How the Test is Performed**

You will wear a hospital gown or clothes without metal zippers or snaps (such as sweatpants and a t-shirt). Make sure you take off your watch, jewelry, and wallet. Some types of metal can cause blurry images.

You will lie on a narrow table that slides into a large tunnel-like scanner.

Some exams use a special dye (contrast). Most of the time, you will get the dye through a vein in your arm or hand before the test. The dye helps the radiologist see certain areas more clearly.

During the MRI, the person who operates the machine will watch you from another room. The test most often lasts 30 to 60 minutes, but may take longer.

**How to Prepare for the Test**

You may be asked not to eat or drink anything for 4 to 6 hours before the scan.

Tell your health care provider if you are afraid of closed spaces (have claustrophobia). You may be given a medicine to help you feel sleepy and less anxious. Your provider may suggest an "open" MRI, in which the machine is not as close to the body.

Before the test, tell your provider if you have:

- Brain aneurysm clips
- Certain types of artificial heart valves
- Heart defibrillator or pacemaker
- Inner ear (cochlear) implants
- Kidney disease or dialysis (you may not be able to receive contrast)
- Recently placed artificial joints
- Certain types of vascular stents
- Worked with sheet metal in the past (you may need tests to check for metal pieces in your eyes)

Because the MRI contains strong magnets, metal objects are not allowed into the room with the MRI scanner:

- Pens, pocketknives, and eyeglasses may fly across the room.
- Items such as jewelry, watches, credit cards, and hearing aids can be damaged.
- Pins, hairpins, metal zippers, and similar metallic items can distort the images.
- Removable dental work should be taken out just before the scan.

**How the Test will Feel**

An MRI exam causes no pain. You will need to lie still. Too much movement can blur MRI images and cause errors.

The table may be hard or cold, but you can ask for a blanket or pillow. The machine makes loud thumping and humming noises when turned on. You can wear ear plugs to help block out the noise.

An intercom in the room allows you to speak to someone at any time. Some MRIs have televisions and special headphones to help the time pass.

There is no recovery time, unless you were given a medicine to relax. After an MRI scan, you can return to your normal diet, activity, and medicines.

**Why the Test is Performed**

This test provides clear pictures of parts of the arm that are hard to see clearly on CT scans.

Your provider may order this test if you have:

- A mass that can be felt on a physical exam
- An abnormal finding on an x-ray or bone scan
- Arm pain and a history of cancer
- Arm or wrist pain that does not get better with treatment
- Bone infection (osteomyelitis)
- Bone pain and fever
- Broken bone
- Decreased motion or "locking up" of the wrist or elbow joint
- Redness or swelling of the wrist or elbow joints
- Injuries to the cartilage and ligaments

### **Normal Results**

A normal result means your arm looks OK.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Degenerative changes due to age
- Abscess
- Bursitis of the elbow or wrist
- Broken bone or fracture
- Ganglion cyst in the wrist
- Infection in the bone
- Ligament, tendon, or cartilage injury in the wrist or elbow
- Muscle damage
- Osteonecrosis (avascular necrosis)
- Tumor or cancer in the bone, muscle, or soft tissue

Talk to your provider if you have questions and concerns.

### **Risks**

MRI contains no radiation. There have been no reported side effects from the magnetic fields and radio waves.

It is also safe to have MRI performed during pregnancy. No side effects or complications have been proven.

The most common type of contrast (dye) used is gadolinium. It is very safe. Allergic reactions to the substance are rare. However, gadolinium can be harmful to people with kidney problems that need dialysis. If you have kidney problems, please tell your provider before the test.

The strong magnetic fields created during an MRI can cause heart pacemakers and other implants to not work as well. It can also cause a piece of metal inside your body to move or shift. For safety reasons, please do not bring anything that contains metal into the scanner room.

### **Considerations**

Tests that may be done instead of an MRI of the arm include:

- CT scan of the arm
- Joint x-ray

A CT scan may be preferred in an emergency. The test is faster than MRI and often available in the emergency room.

### **Arterial stick**

#### **Definition**

An arterial stick is the collection of blood from an artery for laboratory testing.

#### **Alternative Names**

Blood sample - arterial

#### **How the Test Is Performed**

Blood is usually drawn from an artery in the wrist. It may also be drawn from an artery on the inside of the elbow, groin, or other site. If blood is drawn from the wrist, the health care provider will usually first check the pulse. This is to make sure blood is flowing into the hand from the main arteries in the forearm (radial and ulnar arteries).

The procedure is done as follows:

- The area is cleaned with antiseptic.
- A needle is inserted. A small amount of anesthetic may be injected or applied before the needle is inserted.
- Blood flows into a special collecting syringe.
- The needle is removed after enough blood is collected.
- Pressure is applied to the puncture site for 5 to 10 minutes to stop the bleeding. The site will be checked during this time to make sure the bleeding stops.

If it is easier to get blood from one location or side of your body, let the person who is drawing your blood know it before starting the test.

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

Preparation varies with the specific test performed.

#### **How the Test will Feel**



Puncture of an artery may be more uncomfortable than puncture of a vein. This is because arteries are deeper than veins. Arteries also have thicker walls and have more nerves. When the needle is inserted, there may be some discomfort or pain. Afterward, there may be some throbbing.

### **Why the Test Is Performed**

Blood transports oxygen, nutrients, waste products, and other materials within the body. Blood also helps control body temperature, fluids, and the balance of chemicals.

Blood is made up of a fluid portion (plasma) and a cellular portion. Plasma contains substances dissolved in the fluid. The cellular portion is made up mainly of red blood cells, but it also includes white blood cells and platelets.

Because blood has many functions, tests on the blood or its components may give valuable clues to help providers diagnose many medical conditions.

Blood in the arteries (arterial blood) differs from blood in the veins (venous blood) mainly in its content of dissolved gases. Testing arterial blood shows the makeup of the blood before any of its contents are used by the body tissues.

### **Normal Results**

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An arterial stick is done to get blood samples from arteries. Blood samples are mainly taken to measure gases in the arteries. Abnormal results may point to breathing problems or problems with the body's metabolism. Sometimes arterial sticks are done to get blood culture or blood chemistry samples.

### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Hematoma (blood accumulating under the skin)
- Multiple punctures to locate veins
- Infection (a slight risk any time the skin is broken)

There is a slight risk for damage to nearby tissues when the blood is drawn. Blood can be taken from lower-risk sites, and techniques can be used to limit tissue damage.

## **Arteriogram**

### **Definition**

An arteriogram is an imaging test that uses x-rays and a special dye to see inside the arteries. It can be used to view arteries in the heart, brain, kidney, and other parts of the body.

Related tests include:

- Aortic angiography (chest or abdomen)
- Cerebral angiography (brain)
- Coronary angiography (heart)
- Extremity angiography (legs or arms)
- Fluorescein angiography (eyes)
- Pulmonary angiography (lungs)
- Renal arteriography (kidneys)
- Mesenteric angiography (colon or small bowel)
- Pelvic angiography (pelvis)

### **Alternative Names**

Angiogram; Angiography

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

The test is done in a medical facility designed to perform this test. You will lie on an x-ray table. Local anesthetic is used to numb the area where the dye is injected. Most of the time, an artery in the groin will be used. In some cases, an artery in your wrist may be used.

Next, a flexible tube called a catheter (which is the width of the tip of a pen) is inserted into the groin and moved through the artery until it reaches the intended area of the body. The exact procedure depends on the part of the body being examined.

You will not feel the catheter inside of you.

You may ask for a calming medicine (sedative) if you are anxious about the test.

For most tests:

- A dye (contrast) is injected into an artery.
- X-rays are taken to see how the dye flows through your bloodstream.

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

How you should prepare depends on the part of the body being examined. Your health care provider may tell you to stop taking certain drugs that could affect the test, or blood thinning medicines. DO NOT stop taking any medicine without first talking to your provider. In most cases, you may not be able to eat or drink anything for a few hours before the test.

### **How the Test will Feel**

You may have some discomfort from a needle stick. You may feel symptoms such as flushing in the face or other parts of the body when the dye is injected. The exact symptoms will depend on the part of the body being examined.

If you had an injection in your groin area, you will most often be asked to lie flat on your back for a few hours after the test. This is to help avoid bleeding. Lying flat may be uncomfortable for some people.

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

An arteriogram is done to see how blood moves through the arteries. It is also used to check for blocked or damaged arteries. It can be used to visualize tumors or find a source of bleeding.

Usually, an arteriogram is performed at the same time as a treatment. If no treatment is planned, in many areas of the body it has been replaced with CT or MR arteriography.

## **Aspartate aminotransferase (AST) blood test**

### **Definition**

The aspartate aminotransferase (AST) blood test measures the level of the enzyme AST in the blood.

### **Alternative Names**

Aspartate aminotransferase; Serum glutamic-oxaloacetic transaminase; SGOT

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

A blood sample is needed.

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

No special preparation is needed.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

AST is an enzyme found in high levels in the liver, heart, and muscles. It is also found in lesser amounts in other tissues. An enzyme is a protein that causes a specific chemical change in the body.

Injury to the liver results in release of AST into the blood.

This test is mainly done along with other tests (such as ALT, ALP, and bilirubin) to diagnose and monitor liver disease.

### **Normal Results**

The normal range is 8 to 33 U/L.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An increased AST level is often a sign of liver disease. Liver disease is even more likely when the levels of substances checked by other liver blood tests have also increased.

An increased AST level may be due to any of the following:

- Scarring of the liver (cirrhosis)

- Death of liver tissue
- Heart attack
- Too much iron in the body (hemochromatosis)
- Swollen and inflamed liver (hepatitis)
- Lack of blood flow to the liver (liver ischemia)
- Liver cancer or tumor
- Use of drugs that are toxic to the liver, especially alcohol use
- Mononucleosis ("mono")
- Muscle disease or trauma
- Swollen and inflamed pancreas (pancreatitis)

AST level may also increase after:

- Burns (deep)
- Heart procedures
- Seizure
- Surgery

Pregnancy and exercise may also cause an increased AST level.

### **Risks**

There is little risk involved with having your blood taken. Veins vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Risks associated with having blood drawn are slight, but may include:

- Fainting or feeling lightheaded
- Excessive bleeding
- Multiple punctures to locate veins
- Hematoma (blood collecting under the skin)
- Infection (a slight risk any time the skin is broken)

## **Aspergillosis precipitin**

### **Definition**

Aspergillosis precipitin is a laboratory test to detect antibodies in the blood resulting from exposure to the fungus aspergillus.

### **Alternative Names**

Aspergillus immunodiffusion test; Test for precipitating antibodies

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

A blood sample is needed.

The sample is sent to a laboratory where it is examined for precipitin bands that form when aspergillus antibodies are present.

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

There is no special preparation.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Your health care provider may order this test if you have signs of an aspergillosis infection.

### **Normal Results**

A normal test result means you do not have aspergillus antibodies.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A positive result means antibodies to the fungus have been detected. This result means you have been exposed to the fungus at some point, but it does not necessarily mean you have an active infection.

False-negative results are possible. For example, invasive aspergillosis often does not produce a positive result, even though aspergillus is present.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Audiometry**

### **Definition**

An audiometry exam tests your ability to hear sounds. Sounds vary, based on their loudness (intensity) and the speed of sound wave vibrations (tone).

Hearing occurs when sound waves stimulate the nerves of the inner ear. The sound then travels along nerve pathways to the brain.

Sound waves can travel to the inner ear through the ear canal, eardrum, and bones of the middle ear (air conduction). They can also pass through the bones around and behind the ear (bone conduction).

The INTENSITY of sound is measured in decibels (dB):

- A whisper is about 20 dB.
- Loud music (some concerts) is around 80 to 120 dB.
- A jet engine is about 140 to 180 dB.

Sounds greater than 85 dB can cause hearing loss after a few hours. Louder sounds can cause immediate pain, and hearing loss can develop in a very short time.

The TONE of sound is measured in cycles per second (cps) or Hertz:

- Low bass tones range around 50 to 60 Hz.
- Shrill, high-pitched tones range around 10,000 Hz or higher.

The normal range of human hearing is about 20 to 20,000 Hz. Some animals can hear up to 50,000 Hz. Human speech is usually 500 to 3,000 Hz.

### **Alternative Names**

Audiometry; Hearing test; Audiography (audiogram)

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

Your health care provider may test your hearing with simple tests that can be done in the office. These may include completing a questionnaire and listening to whispered voices, tuning forks, or tones from an ear examination scope.

A specialized tuning fork test can help determine the type of hearing loss. The tuning fork is tapped and held in the air on each side of the head to test the ability to hear by air conduction. It is tapped and placed against the bone behind each ear (mastoid bone) to test bone conduction.

A formal hearing testing can give a more exact measure of hearing. Several tests may be done:

- Pure tone testing (audiogram) -- For this test, you wear earphones attached to the audiometer. Pure tones of a specific frequency and volume are delivered to one ear at a time. You are asked to signal when you hear a sound. The minimum volume required to hear each tone is graphed. A device called a bone oscillator is placed against the mastoid bone to test bone conduction.
- Speech audiometry -- This tests your ability to detect and repeat spoken words at different volumes heard through a head set.
- Immittance audiometry -- This test measures the function of the ear drum and the flow of sound through the middle ear. A probe is inserted into the ear and air is pumped through it to change the pressure within the ear as tones are produced. A microphone monitors how well sound is conducted within the ear under different pressures.

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

No special steps are needed.

### **How the Test will Feel**

There is no discomfort. The length of time varies. An initial screening may take about 5 to 10 minutes. Detailed audiometry may take about 1 hour.

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

This test can detect hearing loss at an early stage. It may also be used when you have hearing problems from any cause.

### **Normal Results**

Normal results include:

- The ability to hear a whisper, normal speech, and a ticking watch is normal.
- The ability to hear a tuning fork through air and bone is normal.
- In detailed audiometry, hearing is normal if you can hear tones from 250 to 8,000 Hz at 25 dB or lower.

### **What Abnormal Results Mean**

There are many kinds and degrees of hearing loss. In some types, you only lose the ability to hear high or low tones, or you lose only air or bone conduction. The inability to hear pure tones below 25 dB indicates some hearing loss.

The amount and type of hearing loss may give clues to the cause, and chances of recovering your hearing.

The following conditions may affect test results:

- Acoustic neuroma
- Acoustic trauma from a very loud or intense blast sound
- Age-related hearing loss
- Alport syndrome
- Chronic ear infections
- Labyrinthitis
- Ménière disease
- Ongoing exposure to loud noise, such as at work or from music
- Abnormal bone growth in the middle ear, called otosclerosis
- Ruptured or perforated eardrum

### **Risks**

There is no risk.

### **Considerations**

Other tests may be used to determine how well the inner ear and brain pathways are working. One of these is otoacoustic emission testing (OAE) that detects sounds given off by the inner ear when responding to sound. This test is often done as part of a newborn screening. A head MRI may be done to help diagnose hearing loss due to an acoustic neuroma.

### **Autoimmune liver disease panel**

#### **Definition**

An autoimmune liver disease panel is a group of tests that is done to check for autoimmune liver disease. An autoimmune liver disease means that the body's immune system attacks the liver.

These tests include:

- Anti-liver/kidney microsomal antibodies
- Anti-mitochondrial antibodies
- Anti-nuclear antibodies
- Anti-smooth muscle antibodies
- Serum IgG

The panel may also include other tests. Often, immune protein levels in the blood are also checked.

#### **Alternative Names**

Liver disease test panel - autoimmune

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

A blood sample is taken from a vein.

The blood sample is sent to the lab for testing.

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

You do not need to take special steps before this test.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted to draw blood. Afterward, there may be some throbbing.

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

Autoimmune disorders are a possible cause of liver disease. The most common of these diseases are autoimmune hepatitis and primary biliary cholangitis (formerly called primary biliary cirrhosis).

This group of tests helps your health care provider diagnose liver disease.

### **Normal Results**

#### **PROTEIN LEVELS:**

The normal range for protein levels in the blood will change with each laboratory. Please check with your provider for the normal ranges in your particular laboratory.

#### **ANTIBODIES:**

Negative results on all antibodies are normal.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Blood tests for autoimmune diseases are not wholly accurate. They can have false negative results (you have the disease, but the test is negative) and false positive results (you do not have the disease, but the test is positive).

A weakly positive or low titer positive test for autoimmune disease is often not due to any disease. A positive test on the panel may be a sign of autoimmune hepatitis or other autoimmune liver disease.

If the test is positive mostly for anti-mitochondrial antibodies, you are likely to have primary biliary cholangitis. If the immune proteins are high and albumin is low, you may have liver cirrhosis or chronic active hepatitis.

### **Risks**

Slight risks from having blood drawn include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **B and T cell screen**

#### **Definition**

B and T cell screen is a laboratory test to determine the amount of T and B cells (lymphocytes) in the blood.

#### **Alternative Names**

E-rosetting; T and B lymphocyte assays; B and T lymphocyte assays

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

A blood sample is needed.

Blood could also be obtained by capillary sample (fingerstick or heelstick in infants).

After the blood is drawn, it goes through a two-step process. First, the lymphocytes are separated from other blood parts. Once the cells are separated, identifiers are added to distinguish between T and B cells.

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

Tell your health care provider if you have had any of the following, which might affect your T and B cell count:

- Chemotherapy
- HIV/AIDS
- Radiation therapy
- Recent or current infection
- Steroid therapy
- Stress
- Surgery

#### **How the Test will Feel**



When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

Your provider may order this test if you have signs of certain diseases that weaken the immune system. It may also be used to distinguish between cancerous and noncancerous disease, particularly cancers that involve the blood and bone marrow.

The test may also be used to determine how well treatment for certain conditions is working.

### **Normal Results**

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal T and B cell counts suggest a possible disease. Further testing is needed to confirm a diagnosis.

An increased T cell count may be due to:

- Cancer of white blood cell called a lymphoblast (acute lymphoblastic leukemia)
- Cancer of white blood cells called lymphocytes (chronic lymphocytic leukemia)
- A viral infection called infectious mononucleosis
- Blood cancer that starts in the plasma cells in the bone marrow (multiple myeloma)
- Syphilis, an STD
- Toxoplasmosis, an infection due to a parasite
- Tuberculosis

An increased B cell count may be due to:

- Chronic lymphocytic leukemia
- DiGeorge syndrome
- Multiple myeloma
- Waldenstrom macroglobulinemia

A decreased T cell count may be due to:

- Congenital T-cell deficiency disease, such as Nezelof syndrome, DiGeorge syndrome, or Wiskott-Aldrich syndrome
- Acquired T-cell deficiency states, such as HIV infection or HTLV-1 infection
- B cell proliferative disorders, such as chronic lymphocytic leukemia or Waldenstrom macroglobulinemia

A decreased B cell count may be due to:

- HIV/AIDS
- Acute lymphoblastic leukemia
- Immunodeficiency disorders
- Treatment with certain medicines

### **Risks**

Veins and arteries vary in size from one person 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 lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Barium enema**

#### **Definition**

Barium enema is a special x-ray of the large intestine, which includes the colon and rectum.

#### **Alternative Names**

Lower gastrointestinal series; Lower GI series; Colorectal cancer - lower GI series; Colorectal cancer - barium enema; Crohn disease - lower GI series; Crohn disease - barium enema; Intestinal blockage - lower GI series; Intestinal blockage - barium enema

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

This test may be done in a doctor's office or hospital radiology department. It is done after your colon is completely empty and clean. Your doctor will give you instructions for cleansing your colon.

During the test:

- You lie flat on your back on the x-ray table. An x-ray is taken.
- You then lie on your side. The health care provider gently inserts a well-lubricated tube (enema tube) into your rectum. The tube is connected to a bag that holds a liquid containing barium sulfate. This is a contrast material that highlights specific areas in the colon, creating a clear image.
- The barium flows into your colon. X-rays are taken. A small balloon at the tip of the enema tube may be inflated to help keep the barium inside your colon. The provider monitors the flow of the barium on an x-ray screen.
- Sometimes a small amount of air is delivered into the colon to expand it. This allows for even clearer images. This test is called a double contrast barium enema.
- You are asked to move into different positions. The table is slightly tipped to get different views. At certain times when the x-ray pictures are taken, you are told to hold your breath and be still for a few seconds so the images will not be blurry.
- The enema tube is removed after the x-rays are taken.
- You are then given a bedpan or helped to the toilet, so you can empty your bowels and remove as much of the barium as possible. Afterward, 1 or 2 more x-rays may be taken.

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

Your bowels need to be completely empty for the exam. If they are not empty, the test may miss a problem in your large intestine.

You will be given instructions for cleansing your bowel using an enema or laxatives. This is also called bowel preparation. Follow the instructions exactly.

For 1 to 3 days before the test, you need to be on a clear liquid diet. Examples of clear liquids are:

- Clear coffee or tea
- Fat-free bouillon or broth
- Gelatin
- Sports drinks
- Strained fruit juices
- Water

### **How the Test will Feel**

When barium enters your colon, you may feel like you need to have a bowel movement. You may also have:

- A feeling of fullness
- Moderate to severe cramping
- General discomfort

Taking long, deep breaths may help you relax during the procedure.

It is normal for the stools to be white for a few days after this test. Drink extra fluids for 2 to 4 days. Ask your doctor about a laxative if you develop hard stools.

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

Barium enema is used to:

- Detect or screen for colon cancer
- Diagnose or monitor ulcerative colitis or Crohn disease
- Diagnose the cause of blood in stools, diarrhea, or very hard stools (constipation)

The barium enema test is used much less often than in the past. Colonoscopy is done more often now.

### **Normal Results**

Barium should fill the colon evenly, showing normal bowel shape and position and no blockages.

### **What Abnormal Results Mean**

Abnormal test results may be a sign of:

- Blockage of the large intestine
- Narrowing of the colon above the rectum (Hirschsprung disease in infants)
- Crohn disease or ulcerative colitis

- Cancer in the colon or rectum
- Sliding of one part of the intestine into another (intussusception)
- Small growths that stick out of the lining of the colon, called polyps
- Small, bulging sacs or pouches of the inner lining of the intestine, called diverticula
- Twisted loop of the bowel (volvulus)

### **Risks**

There is low radiation exposure. X-rays are monitored so that the smallest amount of radiation is used. Pregnant women and children are more sensitive to x-ray risks.

A rare, but serious, risk is a hole made in the colon (perforated colon) when the enema tube is inserted.

### **Basic metabolic panel**

#### **Definition**

The basic metabolic panel is a group of blood tests that provides information about your body's metabolism.

#### **Alternative Names**

SMAC7; Sequential multi-channel analysis with computer-7; SMA7; Metabolic panel 7; CHEM-7

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

Your health care provider may ask you to not eat or drink for 8 hours before the test.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

This test is done to evaluate:

- Kidney function
- Blood acid/base balance
- Blood sugar levels
- Blood calcium level

### **Normal Results**

The basic metabolic panel typically measures these blood chemicals. The following are normal ranges for the substances tested:

- BUN: 6 to 20 mg/dL (2.14 to 7.14 mmol/L)
- CO<sub>2</sub> (carbon dioxide): 23 to 29 mmol/L
- Creatinine: 0.8 to 1.2 mg/dL (70.72 to 106.08 micromol/L)
- Glucose: 64 to 100 mg/dL (3.55 to 5.55 mmol/L)
- Serum chloride: 96 to 106 mmol/L
- Serum potassium: 3.7 to 5.2 mEq/L (3.7 to 5.2 mmol/L)
- Serum sodium: 136 to 144 mEq/L (136 to 144 mmol/L)
- Serum calcium: 8.5 to 10.2 mg/dL (2.13 to 2.55 millimol/L)

Key to abbreviations:

- L = liter
- dL = deciliter = 0.1 liter
- mg = milligram
- mmol = millimole
- mEq = milliequivalents

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Abnormal results can be due to a variety of different medical conditions, including kidney failure, breathing problems, diabetes or diabetes-related complications, and medicine side effects. Talk to your provider about the meaning of your results from each test.

## **Bernstein test**

### **Definition**

The Bernstein test is a method to reproduce symptoms of heartburn. It is most often done with other tests to measure esophageal function.

### **Alternative Names**

Acid perfusion test

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

The test is done in a gastroenterology laboratory. A nasogastric (NG) tube is passed through one side of your nose and into your esophagus. Mild hydrochloric acid will be sent down the tube, followed by salt water (saline) solution. This process may be repeated several times.

You will be asked to tell the health care team about any pain or discomfort you have during the test.

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

You will be asked not to eat or drink anything for 8 hours before the test.

### **How the Test will Feel**

You may have a gagging feeling and some discomfort when the tube is put in place. The acid may cause symptoms of heartburn. Your throat may be sore after the test.

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

The test tries to reproduce symptoms of gastroesophageal reflux (stomach acids coming back up into the esophagus). It is done to see if you have the condition.

### **Normal Results**

The test results will be negative.

### **What Abnormal Results Mean**

A positive test shows that your symptoms are caused by esophageal reflux of acid from the stomach.

### **Risks**

There is a risk of gagging or vomiting.

## **Beta-carotene blood test**

### **Definition**

The beta-carotene test measures the level of beta-carotene in the blood.

### **Alternative Names**

Carotene test

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

A blood sample is needed.

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

Follow your health care provider's instructions about not eating or drinking anything for up to 8 hours before the test. You may also be asked not to eat anything with vitamin A (carotene) for 48 hours before the test.

Your provider may also tell you to temporarily stop taking medicines, such as retinol, which may interfere with test results.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing and slight bruising. This soon goes away.

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

Beta-carotene is found in certain foods. It breaks down to become vitamin A in the body.

Your provider may order this test if you have signs that your vitamin A level may be too low, such as:

- Bones or teeth that do not develop correctly
- Dry or inflamed eyes
- Feeling more irritable
- Hair loss
- Loss of appetite
- Night blindness
- Recurring infections

- Skin rashes

The test can also be used to help measure how well your body absorbs fats.

### **Normal Results**

The normal range is 50 to 300 mcg/dL or 0.93 to 5.59 micromol/L.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level may be due to taking too much vitamin A (hypervitaminosis A).

Beta-carotene deficiency may occur if you are malnourished. It can also occur if your body has trouble absorbing fats through the digestive tract such as with:

- Long-term (chronic) lung disease called cystic fibrosis
- Pancreas problems such as swelling and inflammation (pancreatitis) or the organ not producing enough enzymes (pancreatic insufficiency)
- Small intestine disorder called celiac disease

This test plays a valuable role in diagnosing vitamin A deficiency. But the test results must be evaluated along with other clinical findings.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Bile culture**

### **Definition**

Bile culture is a laboratory test to detect disease-causing germs (bacteria, viruses, or fungi) in the biliary system.

### **Alternative Names**

Culture - bile

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

A sample of bile is needed. This can be done using different methods, including gallbladder surgery or a procedure called endoscopic retrograde cholangiopancreatography (ERCP).

The bile sample is sent to a lab. There, it is placed in a special dish called a culture medium to see if bacteria, viruses, or fungi grow on the sample.

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

Preparation depends on the specific method used to obtain the bile sample. Follow your health care provider's instructions exactly.

### **How the Test will Feel**

If bile is taken during gallbladder surgery, you will feel no pain because you are asleep.

If bile is taken during ERCP, you will receive medicine to relax you. You may have some discomfort as the endoscope passes through your mouth, throat, and down the esophagus. This feeling will go away shortly. You may also be given medicine (anesthesia) so that you will sleep lightly for this test. If you are asleep, you will not feel any discomfort.

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

This test is done to detect infection within the biliary system. The biliary system creates, moves, stores, and releases bile to help in digestion.

### **Normal Results**

The test result is normal if no bacteria, virus, or fungus grew in the laboratory dish.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

An abnormal result means bacteria, fungus, or a virus grew in the laboratory dish. This may be a sign of infection.

### **Risks**

Risks depend on the method used to take a sample of the bile. Your provider can explain these risks.

### **Bilirubin - urine**

#### **Definition**

Bilirubin is a yellowish pigment found in bile, a fluid produced by the liver.

This article is about a lab test to measure the amount of bilirubin in the urine. Large amounts of bilirubin in the body can lead to jaundice.

Bilirubin may also be measured with a blood test.

#### **Alternative Names**

Conjugated bilirubin - urine; Direct bilirubin - urine

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

This test can be done on any urine sample.

For an infant, thoroughly wash the area where urine exits the body.

- Open a urine collection bag (a plastic bag with an adhesive paper on one end).
- For males, place the entire penis in the bag and attach the adhesive to the skin.
- For females, place the bag over the labia.
- Diaper as usual over the secured bag.

This procedure may take a few tries. An active baby can move the bag causing urine to go into the diaper.

Check the infant often and change the bag after the infant has urinated into it. Drain the urine from the bag into the container provided by your health care provider.

Deliver the sample to the laboratory or to your provider as soon as possible.

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

Many medicines can interfere with urine test results.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without first talking to your provider.

#### **How the Test will Feel**

The test involves only normal urination, and there is no discomfort.

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

This test may be done to help diagnose liver or gallbladder problems.

#### **Normal Results**

Bilirubin is not normally found in the urine.

#### **What Abnormal Results Mean**

Increased levels of bilirubin in the urine may be due to:

- Biliary tract disease
- Cirrhosis
- Gallstones in the biliary tract
- Hepatitis
- Liver disease
- Tumors of the liver or gallbladder

#### **Considerations**

Bilirubin can break down in light. That is why babies with jaundice are sometimes placed under blue fluorescent lamps.

### **Bilirubin blood test**

#### **Definition**

The bilirubin blood test measures the level of bilirubin in the blood. Bilirubin is a yellowish pigment found in bile, a fluid made by the liver.

Bilirubin can also be measured with a urine test.

#### **Alternative Names**



Total bilirubin - blood; Unconjugated bilirubin - blood; Indirect bilirubin - blood; Conjugated bilirubin - blood; Direct bilirubin - blood; Jaundice - bilirubin blood test; Hyperbilirubinemia - bilirubin blood test

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

A blood sample is needed.

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

You should not eat or drink for at least 4 hours before the test. Your health care provider may instruct you to stop taking medicines that affect the test.

Many drugs may change the bilirubin level in your blood. Make sure your provider knows which medicines you are taking.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

A small amount of older red blood cells are replaced by new blood cells every day. Bilirubin is left after these older blood cells are removed. The liver helps break down bilirubin so that it can be removed from the body in the stool.

A level of bilirubin in the blood of 2.0 mg/dL can lead to jaundice. Jaundice is a yellow color in the skin, mucus membranes, or eyes.

Jaundice is the most common reason to check bilirubin level. The test will likely be ordered when:

- The provider is concerned about a newborn's jaundice (most newborns have some jaundice)
- Jaundice develops in older infants, children, and adults

A bilirubin test is also ordered when the provider suspects a person has liver or gallbladder problems.

### **Normal Results**

It is normal to have some bilirubin in the blood. A normal level is:

- Direct (also called conjugated) bilirubin: less than 0.3 mg/dL (less than 5.1  $\mu\text{mol/L}$ )
- Total bilirubin: 0.1 to 1.2 mg/dL (1.71 to 20.5  $\mu\text{mol/L}$ )

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

In newborns, bilirubin level is higher for the first few days of life. Your child's provider must consider the following when deciding whether your baby's bilirubin level is too high:

- How fast the level has been rising
- Whether the baby was born early
- The baby's age

Jaundice can also occur when more red blood cells than normal are broken down. This can be caused by:

- A blood disorder called erythroblastosis fetalis
- A red blood cell disorder called hemolytic anemia
- Transfusion reaction in which red blood cells that were given in a transfusion are destroyed by the person's immune system

The following liver problems may also cause jaundice or a high bilirubin level:

- Scarring of the liver (cirrhosis)
- Swollen and inflamed liver (hepatitis)
- Other liver disease
- Disorder in which bilirubin is not processed normally by the liver (Gilbert disease)

The following problems with gallbladder or bile ducts may cause higher bilirubin levels:

- Abnormal narrowing of the common bile duct (biliary stricture)
- Cancer of the pancreas or gallbladder
- Gallstones

### **Risks**

There is little risk involved with having your blood taken. Veins vary in size from one person 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.

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood collecting under the skin)
- Infection (a slight risk any time the skin is broken)

## **Biopsy**

### **Definition**

A biopsy is the removal of a small piece of tissue for laboratory examination.

### **Alternative Names**

Tissue sampling

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

There are several different types of biopsies.

A needle biopsy is done using local anesthesia. There are two types.

- Fine needle aspiration uses a small needle attached to a syringe. Very small amounts of tissue cells are removed.
- Core biopsy removes slivers of tissue using a hollow needle attached to a spring-loaded device.

With either type of needle biopsy, the needle is passed several times through the tissue being examined. The doctor uses the needle to remove the tissue sample. Needle biopsies are often done using CT scan, MRI, mammogram, or ultrasound. These imaging tools help guide the doctor to the right area.

An open biopsy is surgery that uses local or general anesthesia. This means you are relaxed (sedated) or asleep and pain free during the procedure. It is done in a hospital operating room. The surgeon makes a cut into the affected area, and the tissue is removed.

A laparoscopic biopsy uses much smaller surgical cuts than open biopsy. A camera-like instrument (laparoscope) and tools can be inserted. The laparoscope helps guide the surgeon to the right place to take the sample.

A skin lesion biopsy is done when a small amount of skin is removed so it can be examined. The skin is tested to look for skin conditions or diseases.

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

Before scheduling the biopsy, tell your health care provider about any medicines you are taking, including herbs and supplements. You may be asked to stop taking some for a while. These include blood thinners such as:

- NSAIDs (aspirin, ibuprofen)
- Clopidogrel (Plavix)
- Warfarin (Coumadin)
- Dabigatran (Pradaxa)
- Rivaroxaban (Xarelto)
- Apixaban (Eliquis)

DO NOT stop or change your medicines without first talking to your provider.

### **How the Test will Feel**

With a needle biopsy, you may feel a small sharp pinch at the site of the biopsy. Local anesthesia is injected to lessen the pain.

In an open or laparoscopic biopsy, general anesthesia is often used so that you will be pain free.

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

A biopsy is most often done to examine tissue for disease.

### **Normal Results**

The tissue removed is normal.

### **What Abnormal Results Mean**

An abnormal biopsy means that the tissue or cells have an unusual structure, shape, size, or condition.

This may mean you have a disease, such as cancer, but it depends on your biopsy.

### **Risks**

Risks of a biopsy include:

- Bleeding
- Infection

### **Considerations**

There are many different types of biopsies and not all are done with a needle or surgery. Ask your provider for more information about the specific type of biopsy you are having.

### **Biopsy - biliary tract**

#### **Definition**

A biliary tract biopsy is the removal of small amounts of cells and fluids from the duodenum, bile ducts, pancreas, or pancreatic duct. The sample is examined under a microscope.

#### **Alternative Names**

Cytology analysis - biliary tract; Biliary tract biopsy

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

A sample for a biliary tract biopsy can be obtained in different ways.

A needle biopsy can be done if you have a well-defined tumor.

- The biopsy site is cleaned.
- A thin needle is inserted into the area to be tested, and a sample of cells and fluid are removed.
- The needle is then removed.
- Pressure is put on the area to stop any bleeding. The site will be covered with a bandage.

If you have a narrowing or blockage of the bile or pancreatic ducts, a sample can be taken during procedures such as:

- Endoscopic retrograde cholangiopancreatography (ERCP)
- Percutaneous transhepatic cholangiogram (PTCA)

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

You may not be able to eat or drink 8 to 12 hours or more before the test. Your health care provider will tell you ahead of time what you need to do.

Make sure you have someone to drive you home.

#### **How the Test will Feel**

How the test will feel depends on the type of procedure used to remove the biopsy sample. With a needle biopsy, you may feel a sting as the needle is inserted. Some people feel a cramping or pinching feeling during the procedure.

Medicines that stop pain and help you relax are commonly used for other biliary tract biopsy methods.

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

A biliary tract biopsy can determine if a tumor started in the liver or spread from another location. It also can determine if the tumor is cancerous.

This test may be done:

- After a physical exam, x-ray, MRI, CT scan, or ultrasound shows abnormal growths in your biliary tract
- To test for diseases or infection

#### **Normal Results**

A normal result means there are no signs of cancer, disease, or infection in the biopsy sample.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- Cancer of the bile ducts (cholangiocarcinoma)
- Cysts in the liver
- Liver cancer
- Pancreatic cancer
- Swelling and scarring of the bile ducts (primary sclerosing cholangitis)

### **Risks**

Risks depend on how the biopsy sample was taken.

Risks may include:

- Bleeding at the biopsy site
- Infection

## **Bladder biopsy**

### **Definition**

Bladder biopsy is a procedure in which small pieces of tissue are removed from the bladder. The tissue is tested under a microscope.

### **Alternative Names**

Biopsy - bladder

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

A bladder biopsy can be done as part of a cystoscopy. Cystoscopy is a procedure that is done to see the inside of the bladder using a thin lighted tube called a cystoscope. A small piece of tissue or the entire abnormal area is removed. The tissue is sent to the lab to be tested if:

- Abnormalities of the bladder are found during this exam
- A tumor is seen

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

You must sign an informed consent form before you have a bladder biopsy. In most cases, you are asked to urinate just before the procedure. You may also be asked to take an antibiotic before the procedure.

For infants and children, the preparation you can provide for this test depends on your child's age, previous experiences, and level of trust. For general information regarding how you can prepare your child, see the following topics:

- Infant test or procedure preparation (birth to 1 year)
- Toddler test or procedure preparation (1 to 3 years)
- Preschooler test or procedure preparation (3 to 6 years)
- School age test or procedure preparation (6 to 12 years)
- Adolescent test or procedure preparation (12 to 18 years)

### **How the Test will Feel**

You may have a slight discomfort as the cystoscope is passed through your urethra into your bladder. You will feel discomfort that is similar to a strong urge to urinate when the fluid has filled your bladder.

You may feel a pinch during the biopsy. There may be a burning sensation when the blood vessels are sealed to stop bleeding (cauterized).

After the cystoscope is removed, your urethra may be sore. You may feel a burning sensation during urination for a day or two. There may be blood in the urine. In most cases, this will go away on its own.

In some cases, the biopsy needs to be taken from a large area. In that case, you may need general anesthesia or sedation before the procedure.

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

This test is most often done to check for cancer of the bladder or urethra.

### **Normal Results**

The bladder wall is smooth. The bladder is of a normal size, shape, and position. There are no blockages, growths, or stones.

### **What Abnormal Results Mean**

The presence of cancer cells indicates bladder cancer. The type of cancer can be determined from the biopsy sample.

Other abnormalities may include:

- Bladder diverticula
- Cysts
- Inflammation
- Infection
- Ulcers

### **Risks**

There is some risk for urinary tract infection.

There is a slight risk for excessive bleeding. There may be a rupture of the bladder wall with the cystoscope or during biopsy.

There is also a risk that the biopsy will fail to detect a serious condition.

### **Considerations**

You will likely have a small amount of blood in your urine shortly after this procedure. If the bleeding continues after you urinate, contact your health care provider.

Also contact your provider if:

- You have pain, chills, or a fever
- You are producing less urine than usual (oliguria)
- You cannot urinate despite a strong urge to do so

### **Bleeding time**

#### **Definition**

Bleeding time is a medical test that measures how fast small blood vessels in the skin stop bleeding.

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

A blood pressure cuff is inflated around your upper arm. While the cuff is on your arm, the health care provider makes two small cuts on the lower arm. They are just deep enough to cause a tiny amount of bleeding.

The blood pressure cuff is immediately deflated. Blotting paper is touched to the cuts every 30 seconds until the bleeding stops. The provider records the time it takes for the cuts to stop bleeding.

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

Certain medicines can change blood test results.

- Tell your provider about all the medicines you take.
- Your provider will tell you if you need to temporarily stop taking any medicines before you have this test. This may include dextran and aspirin or other nonsteroidal anti-inflammatory drugs (NSAIDs).
- DO NOT stop or change your medicines without talking to your doctor first.

#### **How the Test will Feel**

The tiny cuts are very shallow. Most people say it feels like a skin scratch.

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

This test helps diagnose bleeding problems.

#### **Normal Results**

Bleeding normally stops within 1 to 9 minutes. However, values may vary from lab to lab.

#### **What Abnormal Results Mean**

Longer-than-normal bleeding time may be due to:

- Blood vessel defect
- Platelet aggregation defect (clumping problem with platelets, which are parts of the blood that helps the blood clot)
- Thrombocytopenia (low platelet count)

### **Risks**

There is a very slight risk of infection where the skin is cut.

### **Blood culture**

#### **Definition**

A blood culture is a laboratory test to check for bacteria or other germs in a blood sample.

#### **Alternative Names**

Culture - blood

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

A blood sample is needed.

The site where blood will be drawn is first cleaned with an antiseptic such as chlorhexidine. This reduces the chance of an organism from the skin getting into (contaminating) the blood sample and causing a false-positive result (see below).

The sample is sent to a laboratory. There, it is placed in a special dish (culture). It is then watched to see if bacteria or other disease-causing germs grow. A gram stain may also be done. A gram stain is a method of identifying bacteria using a special series of stains (colors). With some infections, bacteria can be found in the blood only intermittently. So, a series of three or more blood cultures may be done to increase the chance of finding the infection.

**How to Prepare for the Test**

There is no special preparation.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

Your health care provider may order this test if you have symptoms of a serious infection, also known as sepsis. Symptoms of sepsis can include high fever, chills, rapid breathing and heart rate, confusion, and low blood pressure.

The blood culture helps identify the type of bacteria causing the infection. This helps your provider determine how best to treat the infection.

**Normal Results**

A normal value means that no bacteria or other germs were seen in your blood sample.

**What Abnormal Results Mean**

An abnormal (positive) result means that germs were identified in your blood. The medical term for this is bacteremia. This can be the result of sepsis. Sepsis is a medical emergency and you will be admitted to a hospital for treatment.

Other types of germs, such as a fungus or a virus, may also be found in a blood culture.

Sometimes, an abnormal result can be due to contamination. This means bacteria may be found, but it came from your skin or from the lab equipment, instead of your blood. This is called a false-positive result. It means you do not have a true infection.

**Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

**Blood differential test****Definition**

The blood differential test measures the percentage of each type of white blood cell (WBC) that you have in your blood. It also reveals if there are any abnormal or immature cells.

**Alternative Names**

Differential; Diff; White blood cell differential count

**How the Test is Performed**

A blood sample is needed.

A laboratory specialist takes a drop of blood from your sample and smears it onto a glass slide.

The smear is stained with a special dye, which helps tell the difference between various types of white blood cells.

Five types of white blood cells, also called leukocytes, normally appear in the blood:

- Neutrophils
- Lymphocytes (B cells and T cells)
- Monocytes
- Eosinophils
- Basophils

A special machine or a health care provider counts the number of each type of cell. The test shows if the number of cells are in proper proportion with one another, and if there is more or less of one cell type.

**How to Prepare for the Test**

No special preparation is necessary.

**How the Test will Feel**



When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is done to diagnose an infection, anemia, or leukemia. It may also be used to monitor one of these conditions, or to see if treatment is working.

### **Normal Results**

The different types of white blood cells are given as a percentage:

- Neutrophils: 40% to 60%
- Lymphocytes: 20% to 40%
- Monocytes: 2% to 8%
- Eosinophils: 1% to 4%
- Basophils: 0.5% to 1%
- Band (young neutrophil): 0% to 3%

### **What Abnormal Results Mean**

Any infection or acute stress increases your number of white blood cells. High white blood cell counts may be due to inflammation, an immune response, or blood diseases such as leukemia. It is important to realize that an abnormal increase in one type of white blood cell can cause a decrease in the percentage of other types of white blood cells.

An increased percentage of neutrophils may be due to:

- Acute infection
- Acute stress
- Eclampsia (seizures or coma in a pregnant woman)
- Gout (type of arthritis due to uric acid buildup in the blood)
- Acute or chronic forms of leukemia
- Myeloproliferative diseases
- Rheumatoid arthritis
- Rheumatic fever (disease due to an infection with group A streptococcus bacteria)
- Thyroiditis (a thyroid disease)
- Trauma
- Cigarette smoking

A decreased percentage of neutrophils may be due to:

- Aplastic anemia
- Chemotherapy
- Influenza (flu)
- Radiation therapy or exposure
- Viral infection
- Widespread severe bacterial infection

An increased percentage of lymphocytes may be due to:

- Chronic bacterial infection
- Infectious hepatitis (liver swelling and inflammation from bacteria or viruses)
- Infectious mononucleosis, or mono (viral infection that causes fever, sore throat, and swollen lymph glands)
- Lymphocytic leukemia (a type of blood cancer)
- Multiple myeloma (a type of blood cancer)
- Viral infection (such as mumps or measles)

A decreased percentage of lymphocytes may be due to:

- Chemotherapy
- HIV/AIDS infection
- Leukemia
- Radiation therapy or exposure
- Sepsis (severe, inflammatory response to bacteria or other germs)
- Steroid use

An increased percentage of monocytes may be due to:

- Chronic inflammatory disease
- Leukemia

- Parasitic infection
- Tuberculosis, or TB (bacterial infection that involves the lungs)
- Viral infection (for example, infectious mononucleosis, mumps, measles)

An increased percentage of eosinophils may be due to:

- Addison disease (adrenal glands do not produce enough hormones)
- Allergic reaction
- Cancer
- Chronic myelogenous leukemia
- Collagen vascular disease
- Hypereosinophilic syndromes
- Parasitic infection

An increased percentage of basophils may be due to:

- After splenectomy
- Allergic reaction
- Chronic myelogenous leukemia (a type of bone marrow cancer)
- Collagen vascular disease
- Myeloproliferative diseases (group of bone marrow diseases)
- Chickenpox

A decreased percentage of basophils may be due to:

- Acute infection
- Cancer
- Severe injury

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Blood gases**

#### **Definition**

Blood gases are a measurement of how much oxygen and carbon dioxide are in your blood. They also determine the acidity (pH) of your blood.

#### **Alternative Names**

Arterial blood gas analysis; ABG; Hypoxia - ABG; Respiratory failure - ABG

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

Usually, blood is taken from an artery. In some cases, blood from a vein may be used.

Blood may be collected from one of the following arteries:

- Radial artery in the wrist
- Femoral artery in the groin
- Brachial artery in the arm

The health care provider may test circulation to the hand before taking a sample of blood from the wrist area.

The provider inserts a small needle through the skin into the artery. The sample is quickly sent to a laboratory for analysis.

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

There is no special preparation. If you are on oxygen therapy, the oxygen concentration must remain constant for 20 minutes before the test.

Tell your provider if you are taking any blood-thinning medicines (anticoagulants), including aspirin.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

The test is used to evaluate respiratory diseases and conditions that affect the lungs. It helps determine the effectiveness of oxygen therapy. The test also provides information about the body's acid/base balance, which can reveal important clues about lung and kidney function and the body's general metabolic state. This is the physical and chemical processes in the body that convert or use energy.

### **Normal Results**

Values at sea level:

- Partial pressure of oxygen (PaO<sub>2</sub>): 75 to 100 millimeters of mercury (mm Hg), or 10.5 to 13.5 kilopascal (kPa)
- Partial pressure of carbon dioxide (PaCO<sub>2</sub>): 38 to 42 mm Hg (5.1 to 5.6 kPa)
- Arterial blood pH: 7.38 to 7.42
- Oxygen saturation (SaO<sub>2</sub>): 94% to 100%
- Bicarbonate (HCO<sub>3</sub>): 22 to 28 milliequivalents per liter (mEq/L)

At altitudes of 3,000 feet (900 meters) and higher, the oxygen value is lower.

Normal value ranges may vary slightly among different laboratories. Some laboratories use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal results may be due to lung, kidney, or metabolic diseases. Head or neck injuries or other injuries that affect breathing can also lead to abnormal results.

### **Risks**

There is little risk when the procedure is done correctly. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Excessive bleeding
- Infection (a slight risk any time the skin is broken)

## **Blood pressure measurement**

### **Definition**

Blood pressure is a measurement of the force on the walls of your arteries as your heart pumps blood through your body.

You can measure your blood pressure at home. You can also have it checked at your health care provider's office or even a fire station.

### **Alternative Names**

Diastolic blood pressure; Systolic blood pressure; Blood pressure reading; Measuring blood pressure; Hypertension - blood pressure measurement; High blood pressure - blood pressure measurement; Sphygmomanometry

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

Sit in a chair with your back supported. Your legs should be uncrossed, and your feet on the floor. Your arm should be supported so that your upper arm is at heart level. Roll up your sleeve so that your arm is bare. Be sure the sleeve is not bunched up and squeezing your arm. If it is, take your arm out of the sleeve, or remove the shirt entirely.

You or your provider will wrap the blood pressure cuff snugly around your upper arm. The lower edge of the cuff should be 1 inch (2.5 cm) above the bend of your elbow.

- The cuff will be inflated quickly. This is done either by pumping the squeeze bulb or pushing a button on the device. You will feel tightness around your arm.
- Next, the valve of the cuff is opened slightly, allowing the pressure to slowly fall.
- As the pressure falls, the reading when the sound of blood pulsing is first heard is recorded. This is the systolic pressure.

- As the air continues to be let out, the sounds will disappear. The point at which the sound stops is recorded. This is the diastolic pressure.

Inflating the cuff too slowly or not inflating it to a high enough pressure may cause a false reading. If you loosen the valve too much, you will not be able to measure your blood pressure.

The procedure may be done two or more times.

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

Before you measure your blood pressure:

- Rest for at least 5 minutes, 10 minutes is better, before blood pressure is taken.
- DO NOT take your blood pressure when you are under stress, have had caffeine or used tobacco in the past 30 minutes, or have exercised recently.

Take 2 or 3 readings at a sitting. Take the readings 1 minute apart. Remain seated. When checking your blood pressure on your own, note the time of the readings. Your provider may suggest that you do your readings at certain times of the day.

- You may want to take your blood pressure in the morning and at night for a week.
- This will give you at least 14 readings and will help your provider make decisions about your blood pressure treatment.

### **How the Test will Feel**

You will feel slight discomfort when the blood pressure cuff is inflated to its highest level.

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

High blood pressure has no symptoms, so you may not know if you have this problem. High blood pressure is often discovered during a visit to the provider for another reason, such as a routine physical exam.

Finding high blood pressure and treating it early can help prevent heart disease, stroke, eye problems, or chronic kidney disease. All adults 18 years and older should have their blood pressure checked regularly:

- Once a year for adults aged 40 years and older
- Once a year for people at increased risk for high blood pressure, including people who are overweight or obese, African Americans, and those with high-normal blood pressure 130 to 139/85 to 89 mm Hg
- Every 3 to 5 years for adults aged 18 to 39 years with blood pressure lower than 130/85 mm Hg who do not have other risk factors

Your provider may recommend more frequent screenings based on your blood pressure levels and other health conditions.

### **Normal Results**

Blood pressure readings are usually given as two numbers. For example, your provider might tell you that your blood pressure is 120 over 80 (written as 120/80 mm Hg). One or both of these numbers can be too high.

Normal blood pressure is when the top number (systolic blood pressure) is below 120 most of the time, and the bottom number (diastolic blood pressure) is below 80 most of the time (written as 120/80 mm Hg).

### **What Abnormal Results Mean**

If your blood pressure is between 120/80 and 130/80 mm Hg, you have elevated blood pressure.

- Your provider will recommend lifestyle changes to bring your blood pressure down to a normal range.
- Medicines are rarely used at this stage.

If your blood pressure is higher than 130/80 but lower than 140/90 mm Hg, you have Stage 1 high blood pressure. When thinking about the best treatment, you and your provider must consider:

- If you have no other diseases or risk factors, your provider may recommend lifestyle changes and repeat the measurements after a few months.
- If your blood pressure remains above 130/80 but lower than 140/90 mm Hg, your provider may recommend medicines to treat high blood pressure.
- If you have other diseases or risk factors, your provider may be more likely to start medicines at the same time as lifestyle changes.

If your blood pressure is higher than 140/90 mm Hg, you have Stage 2 high blood pressure. Your provider will most likely start you on medicines and recommend lifestyle changes.

Most of the time, high blood pressure does not cause symptoms.

### **Considerations**

It is normal for your blood pressure to vary at different times of the day:

- It is usually higher when you are at work.
- It drops slightly when you are at home.
- It is usually lowest when you are sleeping.
- It is normal for your blood pressure to increase suddenly when you wake up. In people with very high blood pressure, this is when they are most at risk for a heart attack and stroke.

Blood pressure readings taken at home may be a better measure of your current blood pressure than those taken at your provider's office.

- Make sure your home blood pressure monitor is accurate.
- Ask your provider to compare your home readings with those taken in the office.

Many people get nervous at the provider's office and have higher readings than they have at home. This is called white coat hypertension. Home blood pressure readings can help detect this problem.

### **Blood smear**

#### **Definition**

A blood smear is a blood test that gives information about the number and shape of blood cells. It is often done as part of or along with a complete blood count (CBC).

#### **Alternative Names**

Peripheral smear; Complete blood count - peripheral; CBC - peripheral

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

A blood sample is needed.

The blood sample is sent to a lab. There, the lab technician looks at it under a microscope. Or, the blood may be examined by an automated machine.

The smear provides this information:

- The number and kinds of white blood cells (differential, or percentage of each type of cell)
- The number and kinds of abnormally shaped blood cells
- A rough estimate of white blood cell and platelet counts

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test may be done as part of a general health exam to help diagnose many illnesses. Or, your health care provider may recommend this test if you have signs of:

- Any known or suspected blood disorder
- Cancer
- Leukemia

A blood smear may also be done to monitor the side effects of chemotherapy or to help diagnose an infection, such as malaria.

#### **Normal Results**

Red blood cells (RBCs) normally are the same size and color and are a lighter color in the center. The blood smear is considered normal if there is:

- Normal appearance of cells
- Normal white blood cell differential

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results mean the size, shape, color, or coating of the RBCs is not normal.

Some abnormalities may be graded on a 4-point scale:

- 1+ means one quarter of cells are affected
- 2+ means one half of cells are affected

- 3+ means three quarters of cells are affected
- 4+ means all of the cells are affected

Presence of cells called target cells may be due to:

- Deficiency of an enzyme called lecithin cholesterol acyl transferase
- Abnormal hemoglobin, the protein in RBCs that carries oxygen (hemoglobinopathies)
- Iron deficiency
- Liver disease
- Spleen removal

Presence of sphere-shaped cells may be due to:

- Low number of RBCs due to the body destroying them (immune hemolytic anemia)
- Low number of RBCs due to some RBCs shaped like spheres (hereditary spherocytosis)
- Increased breakdown of RBCs

Presence of RBCs with an oval shape may be a sign of hereditary elliptocytosis or hereditary ovalocytosis. These are conditions in which RBCs are abnormally shaped.

Presence of fragmented cells may be due to:

- Artificial heart valve
- Disorder in which the proteins that control blood clotting become overactive (disseminated intravascular coagulation)
- Infection in the digestive system producing toxic substances that destroy RBCs, causing kidney injury (hemolytic uremic syndrome)
- Blood disorder that causes blood clots to form in small blood vessels around the body and leads to a low platelet count (thrombotic thrombocytopenic purpura)

Presence of a type of immature RBCs called normoblasts may be due to:

- Cancer that has spread to bone marrow
- Blood disorder called erythroblastosis fetalis that affects a fetus or newborn
- Tuberculosis that has spread from the lungs to other parts of the body through the blood (miliary tuberculosis)
- Disorder of the bone marrow in which the marrow is replaced by fibrous scar tissue (myelofibrosis)
- Removal of spleen
- Severe breakdown of RBCs (hemolysis)
- Disorder in which there is excessive breakdown of hemoglobin (thalassemia)

The presence of cells called burr cells may indicate:

- Abnormally high level of nitrogen waste products in the blood (uremia)

The presence of cells called spur cells may indicate:

- Inability to fully absorb dietary fats through the intestines (abetalipoproteinemia)
- Severe liver disease

The presence of teardrop-shaped cells may indicate:

- Myelofibrosis
- Severe iron deficiency
- Thalassemia major
- Cancer in the bone marrow
- Anemia caused by bone marrow not producing normal blood cells due to toxins or tumor cells (myelophthitic process)

The presence of Howell-Jolly bodies (a type of granule) may indicate:

- Bone marrow does not produce enough healthy blood cells (myelodysplasia)
- Spleen has been removed
- Sickle cell anemia

The presence of Heinz bodies (bits of altered hemoglobin) may indicate:

- Alpha thalassemia
- Congenital hemolytic anemia
- Disorder in which RBCs break down when the body is exposed to certain medicines or is stressed because of infection (G6PD deficiency)
- Unstable form of hemoglobin

The presence of slightly immature RBCs may indicate:



- Anemia with bone marrow recovery
- Hemolytic anemia
- Hemorrhage

The presence of basophilic stippling (a spotted appearance) may indicate:

- Lead poisoning
- Disorder of the bone marrow in which the marrow is replaced by fibrous scar tissue (myelofibrosis)

The presence of sickle cells may indicate sickle cell anemia.

### **Risks**

There is little risk involved with having your blood taken. 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

### **Blood sugar test**

#### **Definition**

A blood sugar test measures the amount of a sugar called glucose in a sample of your blood. Glucose is a major source of energy for most cells of the body, including brain cells. Glucose is a building block for carbohydrates. Carbohydrates are found in fruit, cereal, bread, pasta, and rice. Carbohydrates are quickly turned into glucose in your body. This can raise your blood glucose level.

Hormones made in the body help control blood glucose level.

#### **Alternative Names**

Random blood sugar; Blood sugar level; Fasting blood sugar; Glucose test; Diabetic screening - blood sugar test; Diabetes - blood sugar test

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

A blood sample is needed.

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

The test may be done in the following ways:

- After you have not eaten anything for at least 8 hours (fasting)
- At any time of the day (random)
- Two hours after you drink a certain amount of glucose (oral glucose tolerance test)

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Your health care provider may order this test if you have signs of diabetes. More than likely, the provider will order a fasting blood sugar test.

The blood glucose test is also used to monitor people who already have diabetes.

The test may also be done if you have:

- An increase in how often you need to urinate
- Recently gained a lot of weight
- Blurred vision
- Confusion or a change in the way you normally talk or behave
- Fainting spells
- Seizures (for the first time)
- Unconsciousness or coma

### **SCREENING FOR DIABETES**

This test may also be used to screen a person for diabetes.

High blood sugar and diabetes may not cause symptoms in the early stages. A fasting blood sugar test is almost always done to screen for diabetes.

If you are over age 45, you should be tested every 3 years.

If you're overweight (body mass index, or BMI, of 25 or higher) and have any of the risk factors below, ask your provider about getting tested at an earlier age and more often:

- High blood sugar level on a previous test
- Blood pressure of 140/90 mm Hg or higher, or unhealthy cholesterol levels
- History of heart disease
- Member of a high-risk ethnic group (African American, Latino, Native American, Asian American, or Pacific Islander)
- Woman who has been previously diagnosed with gestational diabetes
- Polycystic ovary disease (condition in which a woman has an imbalance of female sex hormones causing cysts in the ovaries)
- Close relative with diabetes (such as a parent, brother, or sister)
- Not physically active

Children age 10 and older who are overweight and have at least two of the risk factors listed above should be tested for type 2 diabetes every 3 years, even if they have no symptoms.

### **Normal Results**

If you had a fasting blood glucose test, a level between 70 and 100 mg/dL (3.9 and 5.6 mmol/L) is considered normal.

If you had a random blood glucose test, a normal result depends on when you last ate. Most of the time, the blood glucose level will be 125 mg/dL (6.9 mmol/L) or lower.

The examples above show the common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results. Blood glucose measured by a blood test from a vein is considered more accurate than blood glucose measured from a fingerstick with a blood glucose meter, or blood glucose measured by a continuous glucose monitor.

### **What Abnormal Results Mean**

If you had a fasting blood glucose test:

- A level of 100 to 125 mg/dL (5.6 to 6.9 mmol/L) means you have impaired fasting glucose, a type of prediabetes. This increases your risk of developing type 2 diabetes.
- A level of 126 mg/dL (7 mmol/L) or higher usually means you have diabetes.

If you had a random blood glucose test:

- A level of 200 mg/dL (11 mmol/L) or higher often means you have diabetes.
- Your provider will order a fasting blood glucose, A1C test, or glucose tolerance test, depending on your random blood glucose test result.
- In someone who has diabetes, an abnormal result on the random blood glucose test may mean that the diabetes is not well controlled. Talk with your provider about your blood glucose goals if you have diabetes.

Other medical problems can also cause a higher-than-normal blood glucose level, including:

- Overactive thyroid gland
- Pancreatic cancer
- Swelling and inflammation of the pancreas (pancreatitis)
- Stress due to trauma, stroke, heart attack, or surgery
- Rare tumors, including pheochromocytoma, acromegaly, Cushing syndrome, or glucagonoma

A lower-than-normal blood glucose level (hypoglycemia) may be due to:

- Hypopituitarism (a pituitary gland disorder)
- Underactive thyroid gland or adrenal gland
- Tumor in the pancreas (insulinoma - very rare)
- Too little food
- Too much insulin or other diabetes medicines
- Liver or kidney disease
- Weight loss after weight loss surgery
- Vigorous exercise

Some medicines can raise or lower your blood glucose level. Before having the test, tell your provider about all the medicines you are taking.

For some thin young women, a fasting blood sugar level below 70 mg/dL (3.9 mmol/L) may be normal.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Blood typing**

#### **Definition**

Blood typing is a method to tell what type of blood you have. Blood typing is done so you can safely donate your blood or receive a blood transfusion. It is also done to see if you have a substance called Rh factor on the surface of your red blood cells.

Your blood type is based on whether or not certain proteins are on your red blood cells. These proteins are called antigens. Your blood type (or blood group) depends on what types your parents passed down to you.

Blood is often grouped according to the ABO blood typing system. The 4 major blood types are:

- Type A
- Type B
- Type AB
- Type O

#### **Alternative Names**

Cross matching; Rh typing; ABO blood typing; ABO blood type; A blood type; AB blood type; O blood type; Transfusion - blood typing

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

A blood sample is needed. The test to determine your blood group is called ABO typing. Your blood sample is mixed with antibodies against type A and B blood. Then, the sample is checked to see whether or not the blood cells stick together. If blood cells stick together, it means the blood reacted with one of the antibodies.

The second step is called back typing. The liquid part of your blood without cells (serum) is mixed with blood that is known to be type A and type B. People with type A blood have anti-B antibodies. People with type B blood have anti-A antibodies. Type O blood contains both types of antibodies.

The 2 steps above can accurately determine your blood type.

Rh typing uses a method similar to ABO typing. When blood typing is done to see if you have Rh factor on the surface of your red blood cells, the results will be one of these:

- Rh+ (positive), if you have this cell surface protein
- Rh- (negative), if you do not have this cell surface protein

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

No special preparation is necessary for this test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Blood typing is done so you can safely receive a blood transfusion or a transplant. Your blood type must closely match the blood type of the blood you are receiving. If the blood types do not match:

- Your immune system will see the donated red blood cells as foreign.
- Antibodies will develop against the donated red blood cells and attack these blood cells.

The two ways that your blood and the donated blood may not match are:

- A mismatch between blood types A, B, AB, and O. This is the most common form of a mismatch. In most cases, the immune response is very severe.
- Rh factor may not match.

Blood typing is very important during pregnancy. Careful testing can prevent a severe anemia in the newborn and jaundice.

### **Normal Results**

You will be told which ABO blood type you have. It will be one of these:

- Type A blood
- Type B blood
- Type AB blood
- Type O blood

You will also be told whether you have Rh-positive blood or Rh-negative blood.

Based on your results, your health care providers can determine which type of blood you can safely receive:

- If you have type A blood, you can only receive types A and O blood.
- If you have type B blood, you can only receive types B and O blood.
- If you have type AB blood, you can receive types A, B, AB, and O blood.
- If you have type O blood, you can only receive type O blood.
- If you are Rh+, you can receive Rh+ or Rh- blood.
- If you are Rh-, you can only receive Rh- blood.

Type O blood can be given to anyone with any blood type. That is why people with type O blood are called universal blood donors.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Excessive bleeding
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

There are many antigens besides the major ones (A, B, and Rh). Many minor ones are not routinely detected during blood typing. If they are not detected, you may still have a reaction when receiving certain types of blood, even if the A, B, and Rh antigens are matched.

A process called cross-matching followed by a Coombs test can help detect these minor antigens. It is done before transfusions, except in emergency situations.

### **Bone lesion biopsy**

#### **Definition**

A bone lesion biopsy is the removal of a piece of bone or bone marrow for examination.

#### **Alternative Names**

Bone biopsy; Biopsy - bone

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

The test is done in the following way:

- An x-ray, CT or MRI scan is likely used to guide the exact placement of the biopsy instrument.
- The health care provider applies a numbing medicine (local anesthetic) to the area.
- A small cut is then made in the skin.
- A special drill needle is often used. This needle is gently inserted through the cut, then pushed and twisted into the bone.
- Once the sample is obtained, the needle is twisted out.
- Pressure is applied to the site. Once bleeding stops, stitches are applied, and covered with a bandage.
- The sample is sent to a lab for examination.

Bone biopsy may also be done under general anesthesia to remove a larger sample. Then surgery to remove the bone can be done if the biopsy exam shows that there is an abnormal growth or cancer.

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

Follow your provider's instructions on how to prepare. This may include not eating and drinking for several hours before the procedure.

### **How the Test will Feel**

With a needle biopsy, you may feel some discomfort and pressure, even though a local anesthetic is used. You must remain still during the procedure.

After the biopsy, the area may be sore or tender for several days.

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

The most common reasons for bone lesion biopsy are to tell the difference between cancerous and noncancerous bone tumors and to identify other bone or bone marrow problems. It may be performed on people with bone pain and tenderness, particularly if x-ray, CT scan, or other testing reveals a problem.

### **Normal Results**

No abnormal bone tissue is found.

### **What Abnormal Results Mean**

An abnormal result may be any of the following problems.

Benign (noncancerous) bone tumors, such as:

- Bone cyst
- Fibroma
- Osteoblastoma
- Osteoid osteoma

Cancerous tumors, such as:

- Ewing sarcoma
- Multiple myeloma
- Osteosarcoma
- Other types of cancer that may have spread to the bone

Abnormal results may also be due to:

- Osteitis fibrosa (weak and deformed bone)
- Osteomalacia (softening of the bones)
- Osteomyelitis (bone infection)
- Bone marrow disorders (Leukemia or lymphoma)

### **Risks**

Risks of this procedure may include:

- Bone fracture
- Bone infection (osteomyelitis)
- Damage to surrounding tissue
- Discomfort
- Excessive bleeding
- Infection near the biopsy area

A serious risk of this procedure is bone infection. Signs include:

- Fever
- Headache
- Pain with movement
- Redness and swelling of around the biopsy site
- Drainage of pus from the biopsy site

If you have any of these signs, call your provider right away.

People with bone disorders who also have blood clotting disorders may have an increased risk of bleeding.

### **Bone marrow aspiration**

#### **Definition**

Bone marrow is the soft tissue inside bones that helps form blood cells. It is found in the hollow part of most bones. Bone marrow aspiration is the removal of a small amount of this tissue in liquid form for examination.

Bone marrow aspiration is not the same as bone marrow biopsy. A biopsy removes a core of bone tissue for examination.

### **Alternative Names**

Iliac crest tap; Sternal tap; Leukemia - bone marrow aspiration; Aplastic anemia - bone marrow aspiration; Myelodysplastic syndrome - bone marrow aspiration; Thrombocytopenia - bone marrow aspiration; Myelofibrosis - bone marrow aspiration

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

Bone marrow aspiration may be done in the health care provider's office or in a hospital. The bone marrow is removed from your pelvic or breast bone. Sometimes, another bone is selected.

Marrow is removed in the following steps:

- If needed, you are given medicine to help you relax.
- The provider cleans the skin and injects numbing medicine into the area and surface of the bone.
- A special needle is inserted into the bone. The needle has a tube attached to it, which creates suction. A small sample of bone marrow fluid flows into the tube.
- The needle is removed.
- Pressure and then a bandage are applied to the skin.

The bone marrow fluid is sent to a laboratory and examined under a microscope.

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

Tell the provider:

- If you are allergic to any medicines
- If you are pregnant
- If you have bleeding problems
- What medicines you are taking

### **How the Test will Feel**

You will feel a sting and slight burning sensation when the numbing medicine is applied. You may feel pressure as the needle is inserted into the bone, and a sharp and usually painful sucking sensation as the marrow is removed. This feeling lasts for only a few seconds.

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

Your doctor may order this test if you have abnormal types or numbers of red or white blood cells or platelets on a complete blood count.

This test is used to diagnose:

- Anemia (some types)
- Infections
- Leukemia
- Other blood cancers and disorders

It may help determine whether cancers have spread or responded to treatment.

### **Normal Results**

The bone marrow should contain the proper number and types of:

- Blood-forming cells
- Connective tissues
- Fat cells

### **What Abnormal Results Mean**

Abnormal results may be due to cancers of the bone marrow, including:

- Acute lymphocytic leukemia (ALL)
- Acute myelogenous leukemia (AML)
- Chronic lymphocytic leukemia (CLL)
- Chronic myelogenous leukemia (CML)

Abnormal results may also be due to other causes, such as:

- Bone marrow doesn't make enough blood cells (aplastic anemia)
- Bacterial or fungal infections that have spread throughout the body
- Cancer of the lymph tissue (Hodgkin or non-Hodgkin lymphoma)



- A bleeding disorder called idiopathic thrombocytopenic purpura (ITP)
- Blood cancer called (multiple myeloma)
- Disorder in which the bone marrow is replaced by scar tissue (myelofibrosis)
- Disorder in which not enough healthy blood cells are made (myelodysplastic syndrome; MDS)
- Abnormally low amount of platelets, which help blood to clot (primary thrombocytopenia)
- White blood cell cancer called Waldenström macroglobulinemia

### **Risks**

There may be some bleeding at the puncture site. More serious risks, such as serious bleeding or infection, are very rare.

### **Bone marrow biopsy**

#### **Definition**

A bone marrow biopsy is the removal of marrow from inside bone. Bone marrow is the soft tissue inside bones that helps form blood cells. It is found in the hollow part of most bones.

Bone marrow biopsy is not the same as bone marrow aspiration. An aspiration removes a small amount of marrow in liquid form for examination.

#### **Alternative Names**

Biopsy - bone marrow

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

A bone marrow biopsy may be done in the health care provider's office or in a hospital. The sample may be taken from the pelvic or breast bone. Sometimes, another area is used.

Marrow is removed in the following steps:

- If needed, you are given medicine to help you relax.
- The provider cleans the skin and injects numbing medicine into the area and surface of the bone.
- A biopsy needle is inserted into the bone. The center of the needle is removed and the hollowed needle is moved deeper into the bone. This captures a tiny sample, or core, of bone marrow within the needle.
- The sample and needle are removed.
- Pressure and then a bandage are applied to the skin.

A bone marrow aspiration may also be done, usually before the biopsy is taken. After the skin is numbed, the needle is inserted into the bone, and a syringe is used to withdraw the liquid bone marrow. If this is done, the needle will be removed and repositioned. Or, another needle may be used for the biopsy.

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

Tell the provider:

- If you are allergic to any medicines
- What medicines you are taking
- If you have bleeding problems
- If you are pregnant

#### **How the Test will Feel**

You will feel a sharp sting when the numbing medicine is injected. The biopsy needle may also cause a brief, usually dull, pain. Since the inside of the bone cannot be numbed, this test may cause some discomfort.

If a bone marrow aspiration is also done, you may feel a brief, sharp pain as the bone marrow liquid is removed.

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

Your provider may order this test if you have abnormal types or numbers of red or white blood cells or platelets on a complete blood count (CBC).

This test is used to diagnose leukemia, infections, some types of anemia, and other blood disorders. It may also be used to help determine if a cancer has spread or responded to treatment.

#### **Normal Results**

A normal result means the bone marrow contains the proper number and types of blood-forming (hematopoietic) cells, fat cells, and connective tissues.

#### **What Abnormal Results Mean**

Abnormal results may be due to cancers of the bone marrow (leukemia, lymphoma, multiple myeloma, or other cancers).

The results may detect the cause of anemia (too few red blood cells), abnormal white blood cells, or thrombocytopenia (too few platelets).

Specific conditions for which the test may be performed:

- A body-wide fungal infection (disseminated coccidioidomycosis)
- A white blood cell cancer called hairy cell leukemia
- Cancer of the lymph tissue (Hodgkin or non-Hodgkin lymphoma)
- Bone marrow doesn't make enough blood cells (aplastic anemia)
- Blood cancer called multiple myeloma
- Group of disorders in which not enough healthy blood cells are made (myelodysplastic syndrome; MDS)
- A nerve tissue tumor called neuroblastoma
- Bone marrow disease that leads to an abnormal increase in blood cells (polycythemia vera)
- Abnormal protein buildup in tissues and organs (amyloidosis)
- Bone marrow disorder in which the marrow is replaced by fibrous scar tissue (myelofibrosis)
- Bone marrow produces too many platelets (thrombocythemia)
- White blood cell cancer called Waldenström macroglobulinemia
- Unexplained anemia, thrombocytopenia (low platelet count) or leukopenia (low WBC count)

### **Risks**

There may be some bleeding at the puncture site. More serious risks, such as serious bleeding or infection, are very rare.

### **Bone marrow culture**

#### **Definition**

Bone marrow culture is an examination of the soft, fatty tissue found inside certain bones. The bone marrow tissue produces blood cells. This test is done to look for an infection inside the bone marrow.

#### **Alternative Names**

Culture - bone marrow

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

The doctor removes a sample of your bone marrow from the back of your pelvic bone or front of your breast bone. This is done with a small needle inserted into your bone. The procedure is called a bone marrow aspiration or a biopsy.

The tissue sample is sent to a lab. It is placed into a special container called a culture dish. The tissue sample is examined under a microscope each day to see if any bacteria, fungi, or viruses have grown.

If any bacteria, fungi, or viruses are found, other tests may be done to learn which drugs will kill the organisms. Treatment can then be adjusted based on these results.

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

Follow any specific instructions from your health care provider on how to prepare for the test.

Tell the provider:

- If you are allergic to any medicines
- What medicines you are taking
- If you have bleeding problems
- If you are pregnant

#### **How the Test will Feel**

You will feel a sharp sting when numbing medicine is injected. The biopsy needle may also cause a brief, usually dull, pain. Since the inside of the bone cannot be numbed, this test may cause some discomfort.

If a bone marrow aspiration is also done, you may feel a brief, sharp pain as the bone marrow liquid is removed.

Soreness at the site usually lasts from a few hours up to 2 days.

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

You may have this test if you have an unexplained fever or if your provider thinks you have an infection of the bone marrow.

**Normal Results**

No growth of bacteria, viruses, or fungi in the culture is normal.

**What Abnormal Results Mean**

Abnormal results suggest that you have an infection of the bone marrow. The infection may be from bacteria, viruses, or fungi.

**Risks**

There may be some bleeding at the puncture site. More serious risks, such as serious bleeding or infection, are very rare.

**Bone mineral density test****Definition**

A bone mineral density (BMD) test measures how much calcium and other types of minerals are in an area of your bone.

This test helps your health care provider detect osteoporosis and predict your risk for bone fractures.

**Alternative Names**

BMD test; Bone density test; Bone densitometry; DEXA scan; DXA; Dual-energy x-ray absorptiometry; p-DEXA; Osteoporosis - BMD; Dual x-ray absorptiometry

**How the Test is Performed**

Bone density testing can be done in several ways.

The most common and accurate way uses a dual-energy x-ray absorptiometry (DEXA) scan.

DEXA uses low-dose x-rays. (You receive more radiation from a chest x-ray.)

There are two types of DEXA scans:

- Central DEXA -- You lie on a soft table. The scanner passes over your lower spine and hip. In most cases, you do not need to undress. This scan is the best test to predict your risk for fractures, especially of the hip.
- Peripheral DEXA (p-DEXA) -- These smaller machines measure the bone density in your wrist, fingers, leg, or heel. These machines are in health care offices, pharmacies, shopping centers, and at health fairs.

**How to Prepare for the Test**

If you are or could be pregnant, tell your provider before this test is done.

DO NOT take calcium supplements for 24 hours before the test.

You'll be told to remove all metal items from your body, such as jewelry and buckles.

**How the Test will Feel**

The scan is painless. You need to remain still during the test.

**Why the Test is Performed**

Bone mineral density (BMD) tests are used to:

- Diagnose bone loss and osteoporosis
- See how well osteoporosis medicine is working
- Predict your risk for future bone fractures

Bone density testing is recommended for all women age 65 and older.

There is not full agreement on whether men should undergo this type of testing. Some groups recommend testing of men at age 70, while others state that the evidence is not clear enough to say whether men at this age benefit from screening.

Younger women, as well as men of any age, may also need bone density testing if they have risk factors for osteoporosis. These risk factors include:

- Fracturing a bone after age 50
- Strong family history of osteoporosis
- History of treatment for prostate cancer or breast cancer
- History of medical conditions such as rheumatoid arthritis, diabetes, thyroid imbalances, or anorexia nervosa
- Early menopause (either from natural causes or hysterectomy)
- Long-term use of medicines such as corticosteroids, thyroid hormone, or aromatase inhibitors

- Low body weight (less than 127 pounds) or low body mass index (less than 21)
- Significant loss of height
- Long-term tobacco or excessive alcohol use

#### **Normal Results**

The results of your test are usually reported as a T-score and Z-score:

- T-score compares your bone density with that of a healthy young woman.
- Z-score compares your bone density with that of other people of your age, gender, and race.

With either score, a negative number means you have thinner bones than average. The more negative the number, the higher your risk for a bone fracture.

A T-score is within the normal range if it is -1.0 or above.

#### **What Abnormal Results Mean**

Bone mineral density testing does not diagnose fractures. Along with other risk factors you may have, it helps predict your risk for having a bone fracture in the future. Your provider will help you understand the results.

If your T-score is:

- Between -1 and -2.5, you may have early bone loss (osteopenia)
- Below -2.5, you likely have osteoporosis

Treatment recommendation depends on your total fracture risk. This risk can be calculated using the FRAX score. Your provider can tell you more about this. You can also find information about FRAX online.

#### **Risks**

Bone mineral density uses a slight amount of radiation. Most experts feel that the risk is very low compared with the benefits of finding osteoporosis before you break a bone.

#### **Bone scan**

##### **Definition**

A bone scan is an imaging test used to diagnose bone diseases and find out how severe they are.

##### **Alternative Names**

Scintigraphy - bone

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

A bone scan involves injecting a very small amount of radioactive material (radiotracer) into a vein. The substance travels through your blood to the bones and organs. As it wears off, it gives off a bit of radiation. This radiation is detected by a camera that slowly scans your body. The camera takes pictures of how much radiotracer collects in the bones.

If a bone scan is done to see if you have a bone infection, images may be taken shortly after the radioactive material is injected and again 3 to 4 hours later, when it has collected in the bones.

This process is called a 3-phase bone scan.

To evaluate whether cancer has spread to the bone (metastatic bone disease), images are taken only after the 3- to 4-hour delay.

The scanning part of the test will last about 1 hour. The scanner's camera may move above and around you. You may need to change positions.

You will probably be asked to drink extra water after you receive the radiotracer to keep the material from collecting in your bladder.

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

You must remove jewelry and other metal objects. You may be asked to wear a hospital gown.

Tell your health care provider if you are or may be pregnant.

DO NOT take any medicine with bismuth in it, such as Pepto-Bismol, for 4 days before the test.

Follow any other instructions you are given.

##### **How the Test will Feel**

There is a small amount of pain when the needle is inserted. During the scan, there is no pain. You must remain still during the scan. The technologist will tell you when to change positions.

You may experience some discomfort due to lying still for a long period.

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

A bone scan is used to:

- Diagnose a bone tumor or cancer.
- Determine if a cancer that began elsewhere in your body has spread to the bones. Common cancers that spread to the bones include breast, lung, prostate, thyroid, and kidney.
- Diagnose a fracture, when it cannot be seen on a regular x-ray (most commonly hip fractures, stress fractures in the feet or legs, or spine fractures).
- Diagnose a bone infection (osteomyelitis).
- Diagnose or determine the cause of bone pain, when no other cause has been identified.
- Evaluate metabolic disorders, such as osteomalacia, primary hyperparathyroidism, osteoporosis, complex regional pain syndrome, and Paget disease.

### **Normal Results**

Test results are considered normal if the radiotracer is present evenly throughout all the bones.

### **What Abnormal Results Mean**

An abnormal scan will show "hot spots" and/or "cold spots" as compared to surrounding bone. Hot spots are areas where there is an increased collection of the radioactive material. Cold spots are areas that have taken up less of the radioactive material.

Bone scan findings must be compared with other imaging studies, in addition to clinical information. Your provider will discuss any abnormal findings with you.

### **Risks**

If you are pregnant or nursing, the test may be postponed to prevent exposing the baby to radiation. If you must have the test while breastfeeding, you should pump and throw away the breast milk for the next 2 days.

The amount of radiation injected into your vein is very small. All radiation is gone from the body within 2 to 3 days. The radiotracer that is used exposes you to a very small amount of radiation.

The risk is probably no greater than with routine x-rays.

Risks related to the bone radiotracer are rare, but may include:

- Anaphylaxis (severe allergic response)
- Rash
- Swelling

There is a slight risk of infection or bleeding when the needle is inserted into a vein.

### **Bone x-ray**

#### **Definition**

A bone x-ray is an imaging test to look at the bones.

#### **Alternative Names**

X-ray - bone

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

The test is done in a hospital radiology department or in the health care provider's office by an x-ray technician. For the test, you will position the bone to be x-rayed on the table. Pictures are then taken, and the bone is repositioned for different views.

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

Tell the health care provider if you are pregnant. You must remove all jewelry for the x-ray.

#### **How the Test will Feel**

The x-rays are painless. Changing position for getting different views of the bone may be uncomfortable.

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

A bone x-ray is used to look for injuries or conditions affecting the bone.

#### **What Abnormal Results Mean**

Abnormal findings include:

- Fractures or broken bone
- Bone tumors
- Degenerative bone conditions
- Osteomyelitis (inflammation of the bone caused by an infection)

Additional conditions under which the test may be performed:

- Cystic fibrosis
- Multiple endocrine neoplasia (MEN) II
- Multiple myeloma

- Osgood-Schlatter disease
- Osteogenesis imperfecta
- Osteomalacia
- Paget's disease
- Primary hyperparathyroidism
- Rickets

### **Risks**

There is low radiation exposure. X-ray machines are set to provide the smallest amount of radiation exposure needed to produce the image. Most experts feel that the risk is low compared with the benefits.

Children and the fetuses of pregnant women are more sensitive to the risks of the x-ray. A protective shield may be worn over areas not being scanned.

### **Bowel transit time**

#### **Definition**

Bowel transit time refers to how long it takes for the food to move from the mouth to the end of the intestine (anus).

This article talks about the medical test used to determine bowel transit time using a radiopaque marker testing.

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

You will be asked to swallow multiple radiopaque markers (show up on x-ray) in a capsule, bead, or ring.

The movement of the marker in the digestive tract will be tracked using x-ray, done at set times over several days.

The number and location of markers are noted.

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

You may not need to prepare for this test. However, your provider may recommend you follow a high-fiber diet. You will likely be asked to avoid laxatives, enemas, and other medicines that change the way your bowels function.

#### **How the Test will Feel**

You will not feel the capsule move through your digestive system.

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

The test helps determine bowel function. You may need this test done to evaluate the cause of constipation or other problems involving difficulty passing stool.

#### **Normal Results**

The bowel transit time varies, even in the same person.

- The average transit time through the colon in someone who is not constipated is 30 to 40 hours.
- Up to a maximum of 72 hours is still considered normal, although transit time in women may reach up to around 100 hours.

#### **What Abnormal Results Mean**

If more than 20% of the marker is present in the colon after 5 days, you may have slowed bowel function. The report will note what area the markers appear to collect.

### **Risks**

There are no risks.

### **Considerations**

The bowel transit time test is rarely done these days. Instead, bowel transit is often measured with small probes called manometry. Your provider can tell you if this is needed for your condition.

### **Brain natriuretic peptide test**

#### **Definition**

Brain natriuretic peptide (BNP) test is a blood test that measures levels of a protein called BNP that is made by your heart and blood vessels. BNP levels are higher than normal when you have heart failure.

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

A blood sample is needed. The blood is taken from a vein (venipuncture).



This test is most often done in the emergency room or hospital. Results take up to 15 minutes. In some hospitals, a finger prick test with rapid results is available.

#### **How the Test will Feel**

When the needle is inserted to draw blood, you may feel a little pain. Most people feel only a prick or a stinging sensation. Afterward there may be some throbbing or bruising.

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

You may need this test if you have signs of heart failure. Symptoms include shortness of breath and swelling of your legs or abdomen. The test helps make sure the problems are due to your heart and not your lungs, kidneys, or liver.

It is unclear if repeated BNP tests are helpful in guiding treatment in those already diagnosed with heart failure.

#### **Normal Results**

In general, results of less than 100 picograms/milliliter (pg/mL) are a sign a person does not have heart failure.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

BNP levels go up when the heart cannot pump the way it should.

A result greater than 100 pg/mL is abnormal. The higher the number, the more likely heart failure is present and the more severe it is.

Sometimes other conditions can cause high BNP levels. These include:

- Kidney failure
- Pulmonary embolism
- Pulmonary hypertension
- Severe infection (sepsis)
- Lung problems

#### **Risks**

Risks associated with having blood drawn are slight but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

#### **Considerations**

A related test, called the N-terminal pro-BNP test, is done in the same way. It provides similar information, but the normal range is different.

#### **Brain PET scan**

##### **Definition**

A brain positron emission tomography (PET) scan is an imaging test of the brain. It uses a radioactive substance called a tracer to look for disease or injury in the brain.

A PET scan shows how the brain and its tissues are working. Other imaging tests, such as magnetic resonance imaging (MRI) and computed tomography (CT) scans only reveal the structure of the brain.

##### **Alternative Names**

Brain positron emission tomography; PET scan - brain

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

A PET scan requires a small amount of radioactive material (tracer). This tracer is given through a vein (IV), usually on the inside of your elbow. Or, you breathe in the radioactive material as a gas. The tracer travels through your blood and collects in organs and tissues. The tracer helps your health care provider to see certain areas or diseases more clearly.

You wait nearby as the tracer is absorbed by your body. This usually takes about 1 hour.

Then, you lie on a narrow table, which slides into a large tunnel-shaped scanner. The PET scanner detects signals from the tracer. A computer changes the results into 3-D pictures. The images are displayed on a monitor for your provider to read.

You must lie still during test so that the machine can produce clear images of your brain. You may be asked to read or name letters if your memory is being tested.

The test takes between 30 minutes and 2 hours.

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

You may be asked not to eat anything for 4 to 6 hours before the scan. You will be able to drink water.

Tell your provider if:

- You are afraid of close spaces (have claustrophobia). You may be given a medicine to help you feel sleepy and less anxious.
- You are pregnant or think you might be pregnant.
- You have any allergies to injected dye (contrast).
- You have taken insulin for diabetes. You will need special preparation.

Always tell your provider about the medicines you are taking, including those bought without a prescription. Sometimes, medicines interfere with the test results.

### **How the Test will Feel**

You may feel a sharp sting when the needle containing the tracer is placed into your vein.

A PET scan causes no pain. The table may be hard or cold, but you can request a blanket or pillow.

An intercom in the room allows you to speak to someone at any time.

There is no recovery time, unless you were given a medicine to relax.

After the test, drink a lot of fluids to flush the tracer out of your body.

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

A PET scan can show the size, shape, and function of the brain, so your doctor can make sure it is working as well as it should. It is most often used when other tests, such as MRI scan or CT scan, do not provide enough information.

This test can be used to:

- Diagnose cancer
- Prepare for epilepsy surgery
- Help diagnose dementia if other tests and exams do not provide enough information
- Tell the difference between Parkinson disease and other movement disorders

Several PET scans may be taken to determine how well you are responding to treatment for cancer or another illness.

### **Normal Results**

There are no problems detected in the size, shape, or function of the brain. There are no areas in which the tracer has abnormally collected.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Alzheimer disease or dementia
- Brain tumor or spread of cancer from another body area to the brain
- Epilepsy, and may identify where the seizures start in your brain
- Movement disorders (such as Parkinson disease)

### **Risks**

The amount of radiation used in a PET scan is low. It is about the same amount of radiation as in most CT scans. Also, the radiation does not last for long in your body.

Women who are pregnant or are breastfeeding should let their provider know before having this test. Infants and babies developing in the womb are more sensitive to the effects of radiation because their organs are still growing.

It is possible, though very unlikely, to have an allergic reaction to the radioactive substance. Some people have pain, redness, or swelling at the injection site.

### **Considerations**

It is possible to have false results on a PET scan. Blood sugar or insulin levels may affect the test results in people with diabetes.

PET scans may be done along with a CT scan. This combination scan is called a PET/CT.

### **Breast biopsy - stereotactic**

#### **Definition**

A breast biopsy is the removal of breast tissue to examine it for signs of breast cancer or other disorders.

There are several types of breast biopsies, including stereotactic, ultrasound-guided, MRI-guided and excisional breast biopsy. This article focuses on stereotactic breast biopsy, which uses mammography to help pinpoint the spot in the breast that needs to be removed.

### **Alternative Names**

Biopsy - breast - stereotactic; Core needle breast biopsy - stereotactic; Stereotactic breast biopsy; Abnormal mammogram - stereotactic breast biopsy; Breast cancer - stereotactic breast biopsy

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

You are asked to undress from the waist up. During the biopsy, you are awake.

You are most likely asked to lie facing down on the biopsy table. The breast that is being biopsied hangs through an opening in the table. The table is raised and the doctor performs the biopsy from underneath. In some cases, stereotactic breast biopsy is done while you sit in an upright position.

The biopsy is done in the following way:

- The health care provider first cleans the area on your breast. Numbing medicine is injected.
- The breast is pressed down to hold it in position during the procedure. You need to hold still while the biopsy is being done.
- The doctor makes a very small cut on your breast over the area that needs to be biopsied.
- Using a special machine, a needle or sheath is guided to the exact location of the abnormal area. Several samples of breast tissue are taken.
- A small metal clip may be placed into the breast in the biopsy area. The clip marks it for surgical biopsy later, if needed.

The biopsy itself is done using one of the following:

- Hollow needle (called a core needle)
- Vacuum-powered device
- Both a needle and vacuum-powered device

The procedure usually takes about 1 hour. This includes the time it takes for the x-rays. The actual biopsy takes only several minutes.

After the tissue sample has been taken, the needle is removed. Ice and pressure are applied to the site to stop any bleeding. A bandage will be applied to absorb any fluid. Stitches are not needed.

Adhesive strips may be placed over any wound, if needed.

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

The provider will ask about your medical history. A breast exam may be done.

If you take medicines (including aspirin, supplements, or herbs), ask your doctor whether you need to stop taking these before the biopsy.

Tell your doctor if you may be pregnant.

DO NOT use lotion, perfume, powder, or deodorant underneath your arms or on your breasts.

### **How the Test will Feel**

When the numbing medicine is injected, it may sting a bit.

During the procedure, you may feel slight discomfort or light pressure.

Lying on your stomach for up to 1 hour may be uncomfortable. Using cushions or pillows may help. Some people are given a pill to help relax them before the procedure.

After the test, the breast may be sore and tender for several days. Follow instructions on what activities you can do, how to care for your breast, and what medicines you can take for pain.

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

Stereotactic breast biopsy is used when a small growth or an area of calcifications is seen on a mammogram, but cannot be seen using an ultrasound of the breast.

The tissue samples are sent to a pathologist to be examined.

### **Normal Results**

A normal result means there is no sign of cancer.

Your provider will let you know when you need a follow-up mammogram or other tests.

### **What Abnormal Results Mean**

If the biopsy shows benign breast tissue without cancer, you will likely not need surgery.

Sometimes the biopsy results show abnormal signs that are not cancer. In this case, a surgical biopsy might be recommended to remove the whole abnormal area for examination.

Biopsy results may show conditions such as:

- Atypical ductal hyperplasia
- Atypical lobular hyperplasia
- Intraductal papilloma
- Flat epithelial atypia
- Radial scar
- Lobular carcinoma-in-situ

Abnormal results may mean that you have breast cancer. Two main types of breast cancer may be found:

- Ductal carcinoma starts in the tubes (ducts) that move milk from the breast to the nipple. Most breast cancers are of this type.
- Lobular carcinoma starts in parts of the breast called lobules, which produce milk.

Depending on the biopsy results, you may need further surgery or treatment.

Your provider will discuss the meaning of the biopsy results with you.

### **Risks**

There is a slight chance of infection at the injection or surgical cut site.

Bruising is common, but excessive bleeding is rare.

### **Breast biopsy - ultrasound**

#### **Definition**

A breast biopsy is the removal of breast tissue to examine it for signs of breast cancer or other disorders.

There are several types of breast biopsies, including stereotactic, ultrasound-guided, MRI-guided, and excisional breast biopsy. This article focuses on needle-based, ultrasound-guided breast biopsies.

#### **Alternative Names**

Biopsy - breast - ultrasound; Ultrasound-guided breast biopsy; Core needle breast biopsy - ultrasound; Breast cancer - breast biopsy - ultrasound; Abnormal mammogram - breast biopsy - ultrasound

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

You are asked to undress from the waist up. You wear a robe that opens in the front. During the biopsy, you are awake.

You lie on your back.

The biopsy is done in the following way:

- The health care provider cleans the area on your breast.
- Numbing medicine is injected.
- The doctor makes a very small cut on your breast over the area that needs to be biopsied.
- The doctor uses an ultrasound machine to guide the needle to the abnormal area in your breast that needs to be biopsied.
- Several small pieces of tissue are taken.
- A small metal clip may be placed into the breast in the area of the biopsy to mark it, if needed.

The biopsy is done using one of the following:

- Fine needle aspiration
- Hollow needle (called a core needle)
- Vacuum-powered device
- Both a hollow needle and vacuum-powered device

Once the tissue sample has been taken, the needle is removed. Ice and pressure are applied to the site to stop any bleeding. A bandage is applied to absorb any fluid. You do not need any stitches after the needle is taken out. If needed, strips of tape may be placed to close the wound.

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

The provider will ask about your medical history and perform a manual breast exam.

If you take blood thinning medicines (including aspirin, supplements, or herbs), ask your doctor whether you need to stop taking these before the biopsy.

Tell your doctor if you may be pregnant.

DO NOT use lotion, perfume, powder, or deodorant underneath your arms or on your breasts.

### **How the Test will Feel**

When the numbing medicine is injected, it may sting a bit.

During the procedure, you may feel slight discomfort or light pressure.

After the test, the breast may be sore and tender to the touch for several days. You will be given instructions about what activities you can do, how to take care of your breast, and what medicines you can take for pain.

You may have some bruising, and there will be a very small scar where the needle was inserted.

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

An ultrasound-guided breast biopsy may be done to evaluate abnormal findings on a mammogram, breast ultrasound, or MRI.

To determine whether someone has breast cancer, a biopsy must be done. Tissue from the abnormal area is removed and examined under a microscope.

### **Normal Results**

A normal result means there is no sign of cancer or other breast problems.

Your provider will let you know if and when you need a follow-up ultrasound, mammogram or other tests.

### **What Abnormal Results Mean**

A biopsy can identify a number of breast conditions that are not cancer or precancer, including:

- Fibroadenoma (breast lump that usually isn't cancer)
- Fat necrosis

Biopsy results may show conditions such as:

- Atypical ductal hyperplasia
- Atypical lobular hyperplasia
- Flat epithelial atypia
- Intraductal papilloma
- Lobular carcinoma-in-situ
- Radial scar

Abnormal results may mean that you have breast cancer. Two main types of breast cancer may be found:

- Ductal carcinoma starts in the tubes (ducts) that move milk from the breast to the nipple. Most breast cancers are of this type.
- Lobular carcinoma starts in parts of the breast called lobules, which produce milk.

Depending on the biopsy results, you may need further surgery or treatment.

Your provider will discuss the meaning of the biopsy results with you.

### **Risks**

There is a slight chance of infection at the injection or incision site. Excessive bleeding is rare.

### **Breast MRI scan**

#### **Definition**

A breast MRI (magnetic resonance imaging) scan is an imaging test that uses powerful magnets and radio waves to create pictures of the breast and surrounding tissue. It does not use radiation (x-rays).

A breast MRI may be done in combination with mammography or ultrasound. It is not a replacement for mammography.

#### **Alternative Names**

MRI - breast; Magnetic resonance imaging - breast; Breast cancer - MRI; Breast cancer screening - MRI

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

You will wear a hospital gown or clothes without metal snaps or a zipper (sweatpants and a t-shirt). Some types of metal can cause blurry images.

You will lie on your stomach on a narrow table with your breasts hanging down into cushioned openings. The table slides into a large tunnel-like tube.

Some exams require a special dye (contrast). Most of the time, you will get the dye through a vein (IV) in your hand or forearm. The dye helps the doctor (radiologist) see some areas more clearly.

During the MRI, the person who operates the machine will watch you from another room. The test lasts 30 to 60 minutes, but may take longer.

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

You likely won't need to do anything to prepare for the test. Ask your health care provider about eating and drinking before the test.

Tell your provider if you are afraid of tight spaces (have claustrophobia). You may be given a medicine to help you feel sleepy and less anxious. Also, your provider may suggest an "open" MRI. The machine is not as close to the body in this type of test.

Before the test, tell your provider if you have:

- Brain aneurysm clips
- Certain types of artificial heart valves
- Heart defibrillator or pacemaker
- Inner ear (cochlear) implants
- Kidney disease or dialysis (you may not be able to receive the IV contrast)
- Recently placed artificial joints
- Certain types of vascular stents
- Worked with sheet metal in the past (you may need tests to check for metal pieces in your eyes)

Because the MRI contains strong magnets, metal objects are not allowed into the room with the MRI scanner:

- Pens, pocketknives, and eyeglasses may fly across the room.
- Items such as jewelry, watches, credit cards, and hearing aids can be damaged.
- Pins, hairpins, metal zippers, and similar metallic items can distort the images.
- Removable dental work should be taken out just before the scan.

### **How the Test will Feel**

An MRI exam causes no pain. You will need to lie still. Too much movement can blur MRI images and cause errors.

If you are very anxious, you may be given medicine to calm your nerves.

The table may be hard or cold, but you can ask for a blanket or pillow. The machine makes loud thumping and humming noises when turned on. You will likely be given ear plugs to help reduce the noise.

An intercom in the room lets you to speak to someone at any time. Some MRIs have televisions and special headphones to help the time pass.

There is no recovery time, unless you were given a medicine to relax. After an MRI scan, you can return to your normal diet, activity, and medicines unless your doctor tells you otherwise.

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

MRI provides detailed pictures of the breast. It also provides clear pictures of parts of the breast that are hard to see clearly on an ultrasound or mammogram.

Breast MRI may also be performed to:

- Check for more cancer in the same breast or the other breast after breast cancer has been diagnosed
- Distinguish between scar tissue and tumors in the breast
- Evaluate an abnormal result on a mammogram or breast ultrasound
- Evaluate for possible rupture of breast implants
- Find any cancer that remains after surgery or chemotherapy
- Show blood flow through the breast area
- Guide a biopsy

An MRI of the breast may also be done after a mammogram to screen for breast cancer in women who:

- Are at very high risk for breast cancer (those with a strong family history or genetic markers for breast cancer)
- Have very dense breast tissue

Before having a breast MRI, talk to your provider about the pros and cons of having the test. Ask about:

- Your risk for breast cancer



- Whether screening decreases your chance of dying from breast cancer
- Whether there is any harm from breast cancer screening, such as side effects from testing or overtreatment of cancer when discovered

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Breast cancer
- Cysts
- Leaking or ruptured breast implants
- Abnormal breast tissue that is not cancer
- Scar tissue

Consult your provider if you have any questions and concerns.

### **Risks**

MRI contains no radiation. No side effects from the magnetic fields and radio waves have been reported.

The most common type of contrast (dye) used is gadolinium. It is very safe. Allergic reactions to this dye are rare. However, gadolinium can be harmful to people with kidney problems who need dialysis. If you have kidney problems, tell your provider before the test.

The strong magnetic fields created during an MRI can make heart pacemakers and other implants not work as well. It can also cause a piece of metal inside your body to move or shift.

### **Considerations**

Breast MRI is more sensitive than mammogram, especially when it is performed using contrast dye. However, breast MRI may not always be able to distinguish breast cancer from noncancerous breast growths. This can lead to a false-positive result.

MRI also cannot pick up tiny pieces of calcium (microcalcifications), which a mammogram can detect. Certain types of calcifications can be an indication of breast cancer.

A biopsy is needed to confirm the results of a breast MRI.

### **Breast ultrasound**

#### **Definition**

Breast ultrasound is a test that uses sound waves to examine the breasts.

#### **Alternative Names**

Ultrasonography of the breast; Sonogram of the breast; Breast lump - ultrasound

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

You will be asked to undress from the waist up. You will be given a gown to wear.

During the test, you will lie on your back on an examining table.

Your health care provider will place a gel on the skin of your breast. A handheld device, called a transducer, is moved over the breast area. You may be asked to raise your arms above your head and turn to the left or right.

The device sends sound waves to the breast tissue. The sound waves help create a picture that can be seen on a computer screen on the ultrasound machine.

The number of people involved in the test will be limited to protect your privacy.

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

You may want to wear a two-piece outfit, so you do not have to completely undress.

A mammogram may be needed either before or after the exam. Do not use any lotion or powder on your breasts on the day of the exam. Do not use deodorant under your arms. Remove any jewelry from your neck and chest area.

#### **How the Test will Feel**

This test usually does not cause any discomfort, although the gel may feel cool.

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

Breast ultrasound is usually ordered when more information is needed after other tests are done or as a stand-alone test. These tests may include mammogram or breast MRI.

Your provider may order this test if you have:

- A breast lump found during a breast exam
- An abnormal mammogram
- Clear or bloody nipple discharge

A breast ultrasound can:

- Help tell the difference between a solid mass or a cyst
- Help look for a growth if you have clear or bloody fluid coming from your nipple
- Guide a needle during a breast biopsy

### **Normal Results**

A normal result means the breast tissue appears normal.

### **What Abnormal Results Mean**

Ultrasound can help show noncancerous growths such as:

- Cysts, which are, fluid-filled sacs
- Fibroadenomas, which are noncancerous solid growths
- Lipomas, which are noncancerous fatty lumps that can occur anywhere in the body, including the breasts

Breast cancers can also be seen with ultrasound.

Follow-up tests to determine whether treatment may be needed include:

- Open (surgical or excisional) breast biopsy
- Stereotactic breast biopsy (needle biopsy performed using a machine like a mammogram)
- Ultrasound-guided breast biopsy (needle biopsy performed using ultrasound)

### **Risks**

There are no risks associated with breast ultrasound. There is no radiation exposure.

### **Breath alcohol test**

#### **Definition**

A breath alcohol test determines how much alcohol is in your blood. The test measures the amount of alcohol in the air you breathe out (exhale).

#### **Alternative Names**

Alcohol test - breath

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

There are many brands of breath alcohol tests. Each one uses a different method to test the level of alcohol in the breath. The machine may be electronic or manual.

One common tester is the balloon type. You blow up the balloon with one breath until it is full.

You then release the air into a glass tube. The tube is filled with bands of yellow crystals. The bands in the tube change colors (from yellow to green), depending on the alcohol content.

Carefully read the instructions before using the test to make sure you get an accurate result.

If an electronic alcohol meter is used, follow the instructions that come with the meter.

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

Wait 15 minutes after drinking an alcoholic beverage and 1 minute after smoking before starting the test.

#### **How the Test will Feel**

There is no discomfort.

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

When you drink alcohol, the amount of alcohol in your blood goes up. This is called your blood-alcohol level.

When the amount of alcohol in the blood reaches 0.02% to 0.03%, you may feel a relaxing "high."

When that percentage reaches 0.05% to 0.10%, you have:

- Reduced muscle coordination
- A longer reaction time
- Impaired judgment and responses

Driving and operating machinery when you're "high" or drunk (intoxicated) is dangerous. A person with an alcohol level of 0.08% and above is considered legally drunk in most states. (Some states have lower levels than others.)

The alcohol content of exhaled air accurately reflects the alcohol content of the blood.

### **Normal Results**

Normal is when the blood alcohol level is not elevated.

### **What Abnormal Results Mean**

With the balloon method:

- 1 green band means that the blood-alcohol level is 0.05% or lower
- 2 green bands mean a level between 0.05% and 0.10%

- 3 green bands mean a level between 0.10% and 0.15%

### **Risks**

There are no risks with a breath alcohol test.

### **Considerations**

The test does not measure the driving abilities of a person. Driving abilities vary among people with the same blood-alcohol level. Some people with a level below 0.05% may not be able to safely drive. For people who only drink sometimes, judgment problems occur at a level of just 0.02%.

The breath alcohol test helps you to know how much alcohol it takes to raise the blood-alcohol level to a dangerous level. Each person's response to alcohol varies. The test may help you make better decisions about driving after drinking.

### **Bronchoscopic culture**

#### **Definition**

Bronchoscopic culture is a laboratory exam to check a piece of tissue or fluid from the lungs for infection-causing germs.

#### **Alternative Names**

Culture - bronchoscopic

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

A procedure called bronchoscopy is used to get a sample (biopsy or brush) of lung tissue or fluid. The sample is sent to a laboratory. There, it is placed in a special dish (culture). It is then watched to see if bacteria or other disease-causing germs grow. Treatment is based on the results of the culture.

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

Follow your health care provider's instructions on how to prepare for bronchoscopy.

#### **How the Test will Feel**

Your provider will tell you what to expect during bronchoscopy.

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

A bronchoscopic culture is done to find infection in the lung that cannot be accurately detected by a sputum culture. The procedure may find the following things, such as:

- Abnormal secretions
- Abnormal lung tissue
- Abscesses
- Inflammation
- Obstructive lesions, such as cancer or foreign bodies

#### **Normal Results**

No organisms are seen on the culture.

#### **What Abnormal Results Mean**

Abnormal culture results usually indicate a respiratory infection. The infection may be caused by bacteria, viruses, parasites, mycobacteria, or fungi. The results of the culture will help determine the best treatment.

Not all organisms found with bronchoscopic culture need to be treated. Your provider will tell you more about this if needed.

### **Risks**

Your provider can discuss the risks of the bronchoscopy procedure with you.

### **Bronchoscopy**

#### **Definition**

Bronchoscopy is a test to view the airways and diagnose lung disease. It may also be used during the treatment of some lung conditions.

#### **Alternative Names**

Fiberoptic bronchoscopy; Lung cancer - bronchoscopy; Pneumonia - bronchoscopy; Chronic lung disease - bronchoscopy

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

A bronchoscope is a device used to see the inside of the airways and lungs. The scope can be flexible or rigid. A flexible scope is almost always used. It is a tube less than one half inch (1

centimeter) wide and about 2 feet (60 centimeters) long. In rare cases, a rigid bronchoscope is used.

- You will likely get medicines through a vein (IV, or intravenously) to help you relax. Or, you may be asleep under general anesthesia, especially if a rigid scope is used.
- A numbing drug (anesthetic) will be sprayed in your mouth and throat. If bronchoscopy is done through your nose, numbing jelly will be placed in the nostril the tube goes through.
- The scope is gently inserted. It will likely make you cough at first. The coughing will stop as the numbing drug begins to work.
- Your health care provider may send saline solution through the tube. This washes the lungs and allows your provider to collect samples of lung cells, fluids, microbes and other materials inside the air sacs. This part of the procedure is called a lavage.
- Sometimes, tiny brushes, needles, or forceps may be passed through the bronchoscope to take very small tissue samples (biopsies) from your lungs.
- Your provider can also place a stent in your airway or view your lungs with ultrasound during the procedure. A stent is a small tube-like medical device. Ultrasound is a painless imaging method that allows your provider to see inside your body.
- Sometimes ultrasound is used to see the lymph nodes and tissues around your airways.
- At the end of the procedure, the scope is removed.

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

Follow instructions on how to prepare for the test. You will likely be told:

- Not to eat or drink anything for 6 to 12 hours before your test.
- Not to take aspirin, ibuprofen, or other blood-thinning drugs before your procedure. Ask the provider who will do your bronchoscopy if and when to stop taking these drugs.
- Arrange for a ride to and from the hospital.
- Arrange for help with work, child care, or other tasks, as you will likely need to rest the next day.

The test is most often done as an outpatient procedure, and you will go home the same day. Rarely, some people may need to stay overnight in the hospital.

### **How the Test will Feel**

Local anesthetic is used to relax and numb your throat muscles. Until this medicine begins to work, you may feel fluid running down the back of your throat. This may cause you to cough or gag.

Once the medicine takes effect, you may feel pressure or mild tugging as the tube moves through your windpipe. Although you may feel like you are not able to breathe when the tube is in your throat, there is no risk of this happening. The medicines you receive to relax will help with these symptoms. You will likely forget most of the procedure.

When the anesthetic wears off, your throat may be scratchy for several days. After the test, your ability to cough (cough reflex) will return in 1 to 2 hours. You will not be allowed to eat or drink until your cough reflex returns.

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

You may have a bronchoscopy to help your provider diagnose lung problems. Your provider will be able to inspect your airways or take a biopsy sample.

Common reasons to do a bronchoscopy for diagnosis are:

- An imaging test showed abnormal changes of your lung, such as a growth or tumor, changes or scarring of lung tissue, or collapse of one area of your lung.
- To biopsy lymph nodes near your lungs.
- To see why you are coughing up blood.
- To explain shortness of breath or low oxygen levels.
- To see if there is a foreign object in your airway.
- You have a cough that has lasted more than 3 months without any clear cause.
- You have an infection in your lungs and major airways (bronchi) that cannot be diagnosed any other way or need a certain type of diagnosis.
- You inhaled a toxic gas or chemical.
- To see if a lung rejection after a lung transplant is occurring.

You may also have a bronchoscopy to treat a lung or airway problem. For example, it may be done to:

- Remove fluid or mucus plugs from your airways
- Remove a foreign object from your airways
- Widen (dilate) an airway that is blocked or narrowed
- Drain an abscess
- Treat cancer using a number of different techniques
- Wash out an airway

### **Normal Results**

Normal results mean normal cells and fluids are found. No foreign substances or blockages are seen.

### **What Abnormal Results Mean**

Many disorders can be diagnosed with bronchoscopy, including:

- Infections from bacteria, viruses, fungi, parasites, or tuberculosis.
- Lung damage related to allergic-type reactions.
- Lung disorders in which the deep lung tissues become inflamed due to the immune system response, and then damaged. For example, changes from sarcoidosis or rheumatoid arthritis may be found.
- Lung cancer, or cancer in the area between the lungs.
- Narrowing (stenosis) of the trachea or bronchi.
- Acute rejection after a lung transplant.

### **Risks**

Main risks of bronchoscopy are:

- Bleeding from biopsy sites
- Infection

There is also a small risk for:

- Abnormal heart rhythms
- Breathing difficulties
- Fever
- Heart attack, in people with existing heart disease
- Low blood oxygen
- Collapsed lung
- Sore throat

Risks when general anesthesia is used include:

- Muscle pain
- Change in blood pressure
- Slower heart rate
- Nausea and vomiting

### **Buccal smear**

#### **Definition**

A buccal (pronounced "buckle") smear is the painless removal of a sample of cells from the inside of your mouth (cheek) for study.

#### **Alternative Names**

Sex chromatin test; Buccal swab

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

The health care provider will gently scrape the inside of the cheek with a small spatula to collect cells for testing. Sometimes, you can do this yourself.

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

Rinse and wash the mouth as instructed.

#### **How the Test will Feel**

You will feel a scraping sensation as cells are removed from the cheek.

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

This test is done to get cells for chromosome or DNA analysis, most often for genetic testing.

This test may also help establish sexual identity. When the test is used in this way, it's called the sex chromatin test.

**Risks**

There are no risks with this test.

**BUN - blood test****Definition**

BUN stands for blood urea nitrogen. Urea nitrogen is what forms when protein breaks down. A test can be done to measure the amount of urea nitrogen in the blood.

**Alternative Names**

Blood urea nitrogen; Renal insufficiency - BUN; Renal failure - BUN; Renal disease - BUN

**How the Test is Performed**

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

**How to Prepare for the Test**

Many medicines can interfere with blood test results.

- Your health care provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

**How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

**Why the Test is Performed**

The BUN test is often done to check kidney function.

**Normal Results**

The normal result is generally 6 to 20 mg/dL.

Note: Normal values may vary among different labs. Talk to your provider about your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

**What Abnormal Results Mean**

Higher-than-normal level may be due to:

- Congestive heart failure
- Excessive protein level in the gastrointestinal tract
- Gastrointestinal bleeding
- Hypovolemia (dehydration)
- Heart attack
- Kidney disease, including glomerulonephritis, pyelonephritis, and acute tubular necrosis
- Kidney failure
- Shock
- Urinary tract obstruction

Lower-than-normal level may be due to:

- Liver failure
- Low protein diet
- Malnutrition
- Over-hydration

**Considerations**

For people with liver disease, the BUN level may be low, even if the kidneys are normal.

**C1 esterase inhibitor****Definition**

C1 esterase inhibitor (C1-INH) is a protein found in the fluid part of your blood. It controls a protein called C1, which is part of the complement system.

The complement system is a group of nearly 60 proteins in blood plasma or on the surface of some cells. The complement proteins work with your immune system to protect the body from infections. They also help remove dead cells and foreign material. There are nine major complement proteins. They are labeled C1 through C9. Rarely, people may inherit deficiency of some complement proteins. These people are prone to certain infections or autoimmune disorders. This article discusses the test that is done to measure the amount of C1-INH in your blood.



**Alternative Names**

C1 inhibiting factor; C1-INH

**How the Test is Performed**

A blood sample is needed. This is most often taken through a vein. The procedure is called a venipuncture.

**How to Prepare for the Test**

No special preparation is needed.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

**Why the Test is Performed**

You may need this test if you have signs of hereditary or acquired angioedema. Both forms of angioedema are caused by low levels of C1-INH.

Complement factors may also be important in testing for autoimmune diseases, such as systemic lupus erythematosus.

**Normal Results**

Normal value ranges may vary slightly among different laboratories. Your health care provider will also measure the functional activity level of your C1 esterase inhibitor. Talk to your provider about the meaning of your specific test results.

**What Abnormal Results Mean**

Low levels of C1-INH may cause certain types of angioedema. Angioedema results in sudden swelling of the tissues of the face, upper throat and tongue. It may also cause difficulty breathing. Swelling in the intestine and abdominal pain may also occur. There are two types of angioedema that result from decreased levels of C1-INH. Hereditary angioedema affects children and young adults under age 20. Acquired angioedema is seen in adults older than age 40. Adults with acquired angioedema are much more likely to also have other conditions such as cancer or autoimmune disease.

**Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

**CA-125 blood test****Definition**

The CA-125 blood test measures the level of the protein CA-125 in the blood.

**Alternative Names**

Ovarian cancer - CA-125 test

**How the Test Is Performed**

A blood sample is needed.

**How to Prepare for the Test**

No preparation is necessary.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

CA-125 is a protein that is found more in ovarian cancer cells than in other cells.

This blood test is often used to monitor women who have been diagnosed with ovarian cancer. The test is useful if the CA-125 level was high when the cancer was first diagnosed. In these cases, measuring the CA-125 over time is a good tool to determine if ovarian cancer treatment is working.

The CA-125 test may also be done if a woman has symptoms or findings on ultrasound that suggest ovarian cancer.

In general, this test is not used to screen healthy women for ovarian cancer when a diagnosis has not yet been made.

## **Normal Results**

A level above 35 U/mL is considered abnormal.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

## **What Abnormal Results Mean**

In a woman who has ovarian cancer, a rise in CA-125 usually means that the disease has progressed or come back (recurred). A decrease in CA-125 usually means the disease is responding to current treatment.

In a woman who has not been diagnosed with ovarian cancer, a rise in CA-125 may mean a number of things. While it may mean that she has ovarian cancer, it can also indicate other types of cancer, as well as several other diseases, such as endometriosis, which are not cancer.

In healthy women, an elevated CA-125 usually does not mean ovarian cancer is present. Most healthy women with an elevated CA-125 do not have ovarian cancer, or any other cancer.

Any woman with an abnormal CA-125 test needs further tests. Sometimes surgery is needed to confirm the cause.

## **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking 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:

- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Excessive bleeding
- Infection (a slight risk any time the skin is broken)

## **Calcitonin blood test**

### **Definition**

The calcitonin blood test measures the level of the hormone calcitonin in the blood.

### **Alternative Names**

Serum calcitonin

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

A blood sample is needed.

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

There is usually no special preparation needed.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Calcitonin is a hormone produced in C cells of the thyroid gland. The thyroid gland is located inside the front of your lower neck. Calcitonin helps control the breakdown and rebuilding of bone.

A common reason to have the test is if you have had surgery to remove a thyroid tumor called medullary cancer. The test allows your health care provider to evaluate if the tumor has spread (metastasized) or has come back (tumor recurrence).

Your provider may also order a calcitonin test when you have symptoms of medullary cancer of the thyroid or multiple endocrine neoplasia (MEN) syndrome, or a family history of these conditions. Calcitonin may also be higher in other tumors, such as:

- Insulinoma (tumor in the pancreas that produces too much insulin)
- Lung cancer
- VIPoma (cancer that usually grows from islet cells in the pancreas)

## **Normal Results**

A normal value is less than 10 pg/mL.

Women and men can have different normal values, with men having higher values.

Sometimes, calcitonin in the blood is checked several times after you are given a shot (injection) of a special medicine that stimulates calcitonin production.

You will need this extra test if your baseline calcitonin is normal, but your provider suspects you have medullary cancer of the thyroid.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher-than-normal level may indicate:

- Insulinoma
- Lung cancer
- Medullary cancer of thyroid (most common)
- VIPoma

Higher-than-normal levels of calcitonin can also occur in people with kidney disease, smokers, and higher body weight. Also, it increases when taking certain medicines to stop stomach acid production.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Calcium - ionized**

### **Definition**

Ionized calcium is calcium in your blood that is not attached to proteins. It is also called free calcium.

All cells need calcium in order to work. Calcium helps build strong bones and teeth. It is important for heart function. It also helps with muscle contraction, nerve signaling, and blood clotting.

This article discusses the test used to measure the amount of ionized calcium in blood.

### **Alternative Names**

Free calcium; Ionized calcium

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

You should not eat or drink for at least 6 hours before the test.

Many medicines can interfere with blood test results.

- Your health care provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

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

Your provider may order this test if you have signs of bone, kidney, liver or parathyroid disease.

The test may also be done to monitor progress and treatment of these diseases.

Most of the time, blood tests measure your total calcium level. This looks at both ionized calcium and calcium attached to proteins. You may need to have a separate ionized calcium test if you have factors that increase or decrease total calcium levels. These may include abnormal blood levels of albumin or immunoglobulins.

### **Normal Results**

Results generally fall in these ranges:

- Children: 4.8 to 5.3 milligrams per deciliter (mg/dL) or 1.20 to 1.32 millimoles per liter (millimol/L)

- Adults: 4.8 to 5.6 mg/dL or 1.20 to 1.40 millimol/L

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Higher-than-normal levels of ionized calcium may be due to:

- Decreased levels of calcium in the urine from an unknown cause
- Hyperparathyroidism
- Hyperthyroidism
- Milk-alkali syndrome
- Multiple myeloma
- Paget disease
- Sarcoidosis
- Thiazide diuretics
- Thrombocytosis (high platelet count)
- Tumors
- Vitamin A excess
- Vitamin D excess

Lower-than-normal levels may be due to:

- Hypoparathyroidism
- Malabsorption
- Osteomalacia
- Pancreatitis
- Renal failure
- Rickets
- Vitamin D deficiency

### **Calcium - urine**

#### **Definition**

This test measures the amount of calcium in urine. All cells need calcium in order to work.

Calcium helps build strong bones and teeth. It is important for heart function, and helps with muscle contraction, nerve signaling, and blood clotting.

See also: Calcium - blood

#### **Alternative Names**

Urinary Ca+2; Kidney stones - calcium in urine; Renal calculi - calcium in your urine; Parathyroid - calcium in urine

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

A 24-hour urine sample is most often needed:

- On day 1, urinate into the toilet when you wake up in the morning.
- Collect all urine (in a special container) for the next 24 hours.
- On day 2, urinate into the container in the morning when you wake up.
- Cap the container. Keep it in the refrigerator or a cool place during the collection period. Label the container with your name, the date, and the time you finish it, and return it as instructed.

For an infant, thoroughly wash the area where urine exits the body.

- Open a urine collection bag (a plastic bag with an adhesive paper on one end).
- For males, place the entire penis in the bag and attach the adhesive to the skin.
- For females, place the bag over the labia.
- Diaper as usual over the secured bag.

This procedure may take a few tries. An active baby can move the bag, causing urine to go into the diaper. You may need extra collection bags.

Check the infant often and change the bag after the infant has urinated into it. Drain the urine from the bag into the container provided by your health care provider.

Deliver the sample to the laboratory or to your provider as soon as possible.

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

Many medicines can interfere with urine test results.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without first talking to your provider.

### **How the Test will Feel**

The test involves only normal urination, and there is no discomfort.

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

Urine calcium level can help your provider:

- Decide on the best treatment for the most common type of kidney stone, which is made of calcium. This type of stone may occur when there is too much calcium in the urine.
- Monitor someone who has a problem with the parathyroid gland, which helps control calcium level in the blood and urine.
- Diagnose the cause of problems with your blood calcium level or bones.

### **Normal Results**

If you are eating a normal diet, the expected amount of calcium in the urine is 100 to 300 milligrams per day (mg/day) or 2.50 to 7.50 millimoles per 24 hours (mmol/24 hours). If you are eating a diet low in calcium, the amount of calcium in the urine will be 50 to 150 mg/day or 1.25 to 3.75 mmol/24 hours.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

A high level of urine calcium (above 300 mg/day) may be due to:

- Chronic kidney disease
- High vitamin D level
- Leaking of calcium from the kidneys into the urine, which may cause calcium kidney stones
- Sarcoidosis
- Taking too much calcium
- Too much production of parathyroid hormone (PTH) by the parathyroid glands in the neck (hyperparathyroidism)
- Use of loop diuretics (most commonly furosemide, torsemide, or bumetanide)

A low level of urine calcium may be due to:

- Disorders in which the body does not absorb nutrients from food well
- Disorders in which the kidney handles calcium abnormally
- Parathyroid glands in the neck do not produce enough PTH (hypoparathyroidism)
- Use of a thiazide diuretic
- Very low level of vitamin D

### **Calcium blood test**

#### **Definition**

The calcium blood test measures the level of calcium in the blood.

This article discusses the test to measure the total amount of calcium in your blood. About one half of the calcium in the blood is attached to proteins, mainly albumin.

A separate test that measures calcium that is not attached to proteins in your blood is sometimes performed. Such calcium is called free or ionized calcium.

Calcium can also be measured in the urine.

#### **Alternative Names**

Ca<sup>2+</sup>; Serum calcium; Ca<sup>++</sup>; Hyperparathyroidism - calcium level; Osteoporosis - calcium level; Hypercalcemia - calcium level; Hypocalcemia - calcium level

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

A blood sample is needed.

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

Your health care provider may tell you to temporarily stop taking certain medicines that can affect the test. These medicines may include:

- Calcium salts (may be found in nutritional supplements or antacids)
- Lithium
- Thiazide diuretics (water pills)
- Thyroxine
- Vitamin D

Drinking too much milk (2 or more quarts or 2 liters a day or a large amount of other dairy products) or taking too much vitamin D as a dietary supplement can also increase blood calcium levels.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

All cells need calcium in order to work. Calcium helps build strong bones and teeth. It is important for heart function, and helps with muscle contraction, nerve signaling, and blood clotting.

Your doctor may order this test if you have signs or symptoms of:

- Certain bone diseases
- Certain cancers, such as multiple myeloma, or a cancer of the breast, lung, neck, and kidney
- Chronic kidney disease
- Chronic liver disease
- Disorders of the parathyroid glands (hormone made by these glands controls calcium and vitamin D levels in the blood)
- Disorders that affect how your intestines absorb nutrients
- High vitamin D level
- Overactive thyroid gland (hyperthyroidism) or taking too much thyroid hormone medicine

Your doctor may also order this test if you have been on bed rest for a long time.

#### **Normal Results**

Normal values range from 8.5 to 10.2 mg/dL (2.13 to 2.55 millimol/L).

Normal value ranges may vary slightly among different laboratories. Some laboratories use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

A higher than normal level may be due to a number of health conditions. Common causes include:

- Being on bed rest for a long time.
- Consuming too much calcium or vitamin D.
- Hyperparathyroidism (parathyroid glands make too much of their hormone; often associated with a low vitamin D level).
- Infections that cause granulomas such as tuberculosis and certain fungal and mycobacterial infections.
- Multiple myeloma, T cell lymphoma and certain other cancers.
- Metastatic bone tumor (bone cancer that has spread).
- Overactive thyroid gland (hyperthyroidism) or too much thyroid hormone replacement medicine.
- Paget disease. Abnormal bone destruction and regrowth, causing deformity of the affected bones.
- Sarcoidosis. Lymph nodes, lungs, liver, eyes, skin, or other tissues become swollen or inflamed.
- Tumors producing a parathyroid hormone-like substance.
- Use of certain medicines such as lithium, tamoxifen, and thiazides.

A lower than normal levels may be due to:

- Disorders that affect absorption of nutrients from the intestines
- Hypoparathyroidism (parathyroid glands do not make enough of their hormone)
- Kidney failure
- Low blood level of albumin
- Liver disease



- Magnesium deficiency
- Pancreatitis
- Vitamin D deficiency

### **Risks**

There is very little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)
- Multiple punctures to locate veins

### **Caloric stimulation**

#### **Definition**

Caloric stimulation is a test that uses differences in temperature to diagnose damage to the acoustic nerve. This is the nerve that is involved in hearing and balance. The test also checks for damage to the brain stem.

#### **Alternative Names**

Caloric test; Bithermal caloric testing; Cold water calorics; Warm water calorics; Air caloric testing

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

This test stimulates your acoustic nerve by delivering cold or warm water or air into your ear canal. When cold water or air enters your ear and the inner ear changes temperature, it should cause fast, side-to-side eye movements called nystagmus. The test is done in the following way:

- Before the test, your ear, especially the eardrum, will be checked. This is to make sure it is normal.
- One ear is tested at a time.
- A small amount of cold water or air is gently delivered into one of your ears. Your eyes should show an involuntary movement called nystagmus. Then they should turn away from that ear and slowly back. If water is used, it is allowed to drain out of the ear canal.
- Next, a small amount of warm water or air is gently delivered into the same ear. Again, your eyes should show nystagmus. Then they should turn toward that ear and slowly back.
- Your other ear is tested in the same way.

During the test, the health care provider may observe your eyes directly. Most often, this test is done as part of another test called electronystagmography.

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

DO NOT eat a heavy meal before the test. Avoid the following at least 24 hours before the test, because they can affect the results:

- Alcohol
- Allergy medicines
- Caffeine
- Sedatives

DO NOT stop taking your regular medicines without first talking to your provider.

#### **How the Test will Feel**

You may find the cold water or air in the ear uncomfortable. You may feel your eyes scanning back and forth during nystagmus. You may have vertigo, and sometimes, you can also have nausea. This lasts only a very short time. Vomiting is rare.

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

This test may be used to find the cause of:

- Dizziness or vertigo
- Hearing loss that may be due to certain antibiotics or other drugs

It may also be done to look for brain damage in people who are in a coma.

#### **Normal Results**

Rapid, side-to-side eye movements should occur when cold or warm water is placed into the ear. The eye movements should be similar on both sides.

### **What Abnormal Results Mean**

If the rapid, side-to-side eye movements do not occur even after ice cold water is given, there may be damage to the:

- Nerve of the inner ear
- Balance sensors of the inner ear
- Brain

Abnormal results may be due to:

- Poor blood supply to the ear
- Bleeding (hemorrhage)
- Blood clot
- Brain or brain stem damage
- Cholesteatoma (a type of skin cyst in the middle ear and mastoid bone in the skull)
- Birth defects of the ear structure or brain
- Damage to the ear nerves
- Poisoning
- Rubella that damages the acoustic nerve
- Trauma

The test may also be done to diagnose or rule out:

- Acoustic neuroma (tumor of the acoustic nerve)
- Benign positional vertigo (a type of dizziness)
- Labyrinthitis (irritation and swelling of the inner ear)
- Meniere disease (inner ear disorder that affects balance and hearing)

### **Risks**

Too much water pressure can injure an already damaged eardrum. This rarely occurs because the amount of water to be used is measured.

Water caloric stimulation should not be done if the eardrum is torn (perforated). This is because it can cause an ear infection. It also should not be done during an episode of vertigo because it can make symptoms worse.

### **Campylobacter serology test**

#### **Definition**

Campylobacter serology test is a blood test to look for antibodies to bacteria called campylobacter.

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

A blood sample is needed.

The sample is sent to a lab. There, tests are done to look for antibodies to campylobacter. Antibody production increases during the infection. When the illness first starts, few antibodies are detected. For this reason, blood tests need to be repeated 10 days to 2 weeks later.

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

There is no special preparation.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test detects the presence of antibodies to campylobacter in the blood. Campylobacter infection can cause diarrheal illness. A blood test is rarely done to diagnose campylobacter diarrheal illness. It is used if your health care provider thinks you are having complications from this infection, such as reactive arthritis or Guillain-Barré syndrome.

#### **Normal Results**

A normal test result means no antibodies to campylobacter are present. This is called a negative result.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

An abnormal (positive) result means that antibodies against campylobacter have been detected. This means you have come in contact with the bacteria.

Tests are often repeated during the course of an illness to detect a rise in antibody levels. This rise helps to confirm an active infection. A low level may be a sign of a previous infection rather than current disease.

### **Risks**

Veins and arteries vary in size from one person 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 lightheaded
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

### **Candida auris infection**

#### **Definition**

*Candida auris* (*C auris*) is a type of yeast (fungus). It can cause a severe infection in hospital or nursing home patients. These patients are often already very sick.

*C auris* infections often do not get better with the antifungal medicines that usually treat candida infections. When this occurs, the fungus is said to be resistant to antifungal medicines. This makes it very hard to treat the infection.

*C auris* infection is rare in healthy people.

#### **Alternative Names**

Candida auris; Candida; C auris; Fungal - auris; Fungus - auris

#### **Causes**

Some patients people carry *C auris* on their bodies without it making them sick. This is called "colonization." This means they can easily spread the germ without knowing it. However, people who are colonized with *C auris* are still at risk for getting an infection from the fungus.

*C auris* can be spread from person-to-person or from contact with objects or equipment. Hospital or long-term nursing home patients can be colonized with *C auris*. They can spread it to objects in the facility, such as bedside tables and hand rails. Health care providers and visiting family and friends who have contact with a patient with *C auris* can spread it to other patients.

Once *C auris* enters the body, it can cause a severe infection of the bloodstream and organs. This is more likely to occur in people with a weakened immune system. People who have breathing or feeding tubes or IV catheters are at the highest risk of infection.

Other risk factors for *C auris* infection include:

- Living in a nursing home or making many visits to the hospital
- Taking antibiotic or antifungal medicines often
- Having many medical problems
- Having had a recent surgery

*C auris* infections have occurred in people of all ages.

#### **Symptoms**

*C auris* infections can be hard to identify for the following reasons:

- Symptoms of a *C auris* infection are similar to those caused by other fungal infections.
- Patients who have a *C auris* infection are often already very sick. Symptoms of infection are hard to tell apart from other symptoms.
- *C auris* can be mistaken for other types of fungus unless special lab tests are used to identify it.

High fever with chills that does not get better after taking antibiotics may be a sign of a *C auris* infection. Tell your provider right away if you or a loved one has an infection that is not getting better, even after treatment.

#### **Exams and Tests**

A *C auris* infection can't be diagnosed using standard methods. If your provider thinks your illness is caused by *C auris*, they will need to use special lab tests.

Blood tests include:

- CBC with differential

- Blood cultures
- Basic metabolic panel
- B-1,3 glucan test (testing for a specific sugar found on some fungi)

Your provider also may suggest testing if they suspect you have been colonized with *C auris*, or if you have tested positive for *C auris* before.

### **Treatment**

*C auris* infections are often treated with antifungal medicines called echinocandins. Other types of antifungal medicines also may be used.

Some *C auris* infections do not respond to any of the main classes of antifungal medicines. In such cases, more than one antifungal drug or higher doses of these drugs may be used.

### **Outlook (Prognosis)**

Infections with *C auris* can be hard to treat because of its resistance to antifungal medicines. How well a person does will depend on:

- How severe the infection is
- Whether the infection has spread to the bloodstream and organs
- The person's overall health

### **Possible Complications**

*C auris* infections that spread to the bloodstream and organs in very ill people can often lead to death.

### **When to Contact a Medical Professional**

Contact your provider if:

- You have fever and chills that don't improve, even after antibiotic treatment
- You have a fungal infection that doesn't improve, even after antifungal treatment
- You develop fever and chills soon after coming in contact with a person who has a *C auris* infection

### **Prevention**

Follow these steps to prevent the spread of *C auris*:

- Wash your hands thoroughly with soap and water. Or, use an alcohol-based hand sanitizer. Do this before and after contact with people who have this infection and before and after touching any equipment in their room.
- Make sure health care providers wash their hands or use hand sanitizer and wear gloves and gowns when interacting with patients. Don't be afraid to speak up if you notice any lapses in good hygiene.
- If a loved one has a *C auris* infection, they should be isolated from other patients and kept in a separate room.
- If you are visiting your loved one who has been isolated from other patients, please follow the directions of the healthcare workers on the procedure to enter and exit the room to minimize the chance of spreading the fungus.
- These precautions should also be used for people who are colonized with *C auris* until their provider determines they can no longer spread the fungus.

Contact your provider right away if you suspect that you or someone you know has this infection.

### **Capillary nail refill test**

#### **Definition**

The capillary nail refill test is a quick test done on the nail beds. It is used to monitor dehydration and the amount of blood flow to tissue.

#### **Alternative Names**

Nail blanch test; Capillary refill time

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

Pressure is applied to the nail bed until it turns white. This indicates that the blood has been forced from the tissue under the nail. It is called blanching. Once the tissue has blanched, pressure is removed.

While the person holds their hand above their heart, the health care provider measures the time it takes for blood to return to the tissue. Return of blood is indicated by the nail turning back to a pink color.

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

Remove colored nail polish before this test.

**How the Test will Feel**

There will be minor pressure to the bed of your nail. This should not cause discomfort.

**Why the Test is Performed**

Tissues need oxygen to survive. Oxygen is carried to various parts of the body by the blood (vascular) system.

This test measures how well the vascular system works in your hands and feet -- the parts of your body that are farthest from the heart.

**Normal Results**

If there is good blood flow to the nail bed, a pink color should return in less than 2 seconds after pressure is removed.

**What Abnormal Results Mean**

Blanch times that are greater than 2 seconds may indicate:

- Dehydration
- Hypothermia
- Peripheral vascular disease (PVD)
- Shock

**Capillary sample****Definition**

A capillary sample is a blood sample collected by pricking the skin. Capillaries are tiny blood vessels near the surface of the skin.

**Alternative Names**

Blood sample - capillary; Fingerstick; Heelstick

**How the Test is Performed**

The test is done in the following way:

- The area is cleansed with antiseptic.
- The skin of the finger, heel or another area is pricked with a sharp needle or a lancet.
- The blood may be collected in a pipette (small glass tube), on a slide, onto a test strip, or into a small container.
- Cotton or a bandage may be applied to the puncture site if there is any continued bleeding.

**How the Test will Feel**

Some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

**Why the Test is Performed**

Blood transports oxygen, food, waste products, and other materials within the body. It also helps regulate body temperature. Blood is made up of cells and a fluid called plasma. Plasma contains various dissolved substances. The cells are mainly red blood cells, white blood cells and platelets. Because blood has many functions, tests on the blood or its components provide valuable clues in the diagnosis of medical conditions.

Capillary blood sampling has several advantages over drawing blood from a vein:

- It is easy to obtain (it can be difficult to obtain blood from the veins, especially in infants).
- There are several collection sites on the body, and these sites can be rotated.
- Testing can be done at home and with little training. For example, persons with diabetes must check their blood sugar several times a day using capillary blood sampling.

Disadvantages to capillary blood sampling include:

- Only a limited amount of blood can be drawn using this method.
- The procedure has some risks (see below).
- Capillary blood sampling may result in inaccurate results, such as falsely elevated sugar, electrolyte, and blood count values.

**What Abnormal Results Mean**

Results vary depending on the test done. Your health care provider can tell you more.

**Risks**

Risks of this test may include any of the following:

- Excessive bleeding
- Fainting or feeling lightheaded

- Infection (a slight risk any time the skin is broken)
- Scarring (occurs when there have been multiple punctures in the same area)
- Calcified nodules (sometimes occurs in infants, but usually disappear by 30 months of age)
- Damage to blood cells from this method of collection can sometimes cause inaccurate test results and the need to repeat the test with blood drawn from a vein

## **Capsule endoscopy**

### **Definition**

Endoscopy is a way of looking inside the body. Endoscopy is often done with a tube put into the body that the doctor can use to look inside.

Another way to look inside is to put a camera in a capsule (capsule endoscopy). This capsule includes one or two tiny cameras, a light bulb, a battery, and a radio transmitter.

It is about the size of a large vitamin pill. The person swallows the capsule, and it takes pictures all the way through the digestive (gastrointestinal) tract.

- The radio transmitter sends the photos to a recorder the person wears on their waist or shoulder.
- A technician downloads the photos from the recorder to a computer, and the doctor looks at them.
- The camera comes out with a bowel movement and is flushed down the toilet safely.

### **Alternative Names**

Capsule enteroscopy; Wireless capsule endoscopy; Video capsule endoscopy (VCE); Small bowel capsule endoscopy (SBCE)

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

This test can be started in the doctor's office.

- The capsule is the size of a large vitamin pill, about an inch (2.5 centimeters) long and less than ½ inch (1.3 centimeters) wide. Each capsule is used only once.
- The health care provider may ask you to lie down or sit up while swallowing the capsule. Capsule endoscope will have a slippery coating, so it is easier to swallow.

The capsule is not digested or absorbed. It travels through the digestive system following the same path food travels. It leaves the body in a bowel movement and can be flushed down the toilet without harming the plumbing.

The recorder will be placed on your waist or shoulder. Sometimes a few antenna patches may also be put on your body. During the test, the small light on a recorder will blink. If it stops blinking, call your provider.

The capsule may be in your body for several hours or several days. Everyone is different.

- Most of the time, the capsule leaves the body within 24 hours. Flush the capsule down the toilet.
- If you do not see the capsule in the toilet within two weeks of swallowing it, tell your provider. You may need an x-ray to see if the capsule is still in your body.

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

Follow your provider's instructions. If you do not follow instructions carefully, the test may have to be done a different day.

Your provider may ask you to:

- Take medicine to clear your bowels before this test
- Have only clear liquids for 24 hours before this test
- Have nothing to eat or drink, including water, for about 12 hours before you swallow the capsule

**DO NOT** smoke for 24 hours before this test.

Be sure to tell your doctor:

- About all the medicine and drugs you take, including prescription medicine, over-the-counter (OTC) medicine, vitamins, minerals, supplements, and herbs. You may be asked to not take some medicines during this test, because they could interfere with the camera.
- If you are allergic to any medicine.
- If you have ever had any blockages of the bowel.
- About any medical conditions, such as problems swallowing or heart or lung disease.
- If you have a pacemaker, defibrillator, or other implanted device.



- If you have had abdominal surgery or any problems with your bowel.

On the day of the test, go to the provider's office wearing loose fitting, two-piece clothing. While the capsule is in your body you should not have an MRI.

#### **How the Test will Feel**

You will be told what to expect before the test is started. Most people consider this test comfortable.

While the capsule is in your body you can do most normal activities, but not heavy lifting or strenuous exercise. If you plan to work on the day of the test, tell your provider how active you will be on the job.

Your provider will tell you when you can eat and drink again.

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

Capsule endoscopy is a way for the doctor to see inside your digestive system.

There are many problems it can look for, including:

- Bleeding
- Ulcers
- Polyps
- Tumors or cancer
- Inflammatory bowel disease
- Crohn disease
- Celiac disease

#### **Normal Results**

The camera takes thousands of color photos of your digestive tract during this test. These pictures are downloaded to a computer and software turns them into a video. Your provider watches the video to look for problems. It may take up to a week for you to learn the results. If no problems are found, your results are normal.

#### **What Abnormal Results Mean**

Your provider will tell you if they find a problem with your digestive tract, what it means, and how it can be treated.

#### **Risks**

There are very few problems that can occur with capsule endoscopy. Call your provider right away if, after swallowing the capsule, you:

- Have a fever
- Have trouble swallowing
- Throw up
- Have chest pain, cramping, or abdominal pain

If your intestines are blocked or narrow, the capsule can get stuck. If this happens, you may need surgery to remove the capsule, although this is rare.

If you have an MRI or go near a powerful magnetic field (like a ham radio) you could have serious damage to the digestive tract and abdomen.

#### **Cardiac catheterization**

##### **Definition**

Cardiac catheterization involves passing a thin flexible tube (catheter) into the right or left side of the heart. The catheter is most often inserted from the groin or the arm.

##### **Alternative Names**

Catheterization - cardiac; Heart catheterization; Angina - cardiac catheterization; CAD - cardiac catheterization; Coronary artery disease - cardiac catheterization; Heart valve - cardiac catheterization; Heart failure - cardiac catheterization

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

You will get medicine before the test to help you relax.

The health care provider will clean a site on your arm, neck, or groin and insert a line into one of your veins. This is called an intravenous (IV) line.

A larger thin plastic tube called a sheath is placed into a vein or artery in your leg or arm. Then longer plastic tubes called catheters are carefully moved up into the heart using live x-rays as a guide. Then the doctor can:

- Collect blood samples from the heart

- Measure pressure and blood flow in the heart's chambers and in the large arteries around the heart
- Measure the oxygen in different parts of your heart
- Examine the arteries of the heart
- Perform a biopsy on the heart muscle

For some procedures, you may be injected with a dye that helps your provider to visualize the structures and vessels within the heart.

If you have a blockage, you may have angioplasty and a stent placed during the procedure. The test may last 30 to 60 minutes. If you also need special procedures, the test may take longer. If the catheter is placed in your groin, you will often be asked to lie flat on your back for a few to several hours after the test to avoid bleeding.

You will be told how to take care of yourself when you go home after the procedure is done.

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

You should not eat or drink for 6 to 8 hours before the test. The test takes place in a hospital and you will be asked to wear a hospital gown. Sometimes, you will need to spend the night before the test in the hospital. Otherwise, you will come to the hospital the morning of the procedure.

Your provider will explain the procedure and its risks. A witnessed, signed consent form for the procedure is required.

Tell your provider if you:

- Are allergic to seafood or any medicines
- Have had a bad reaction to contrast dye or iodine in the past
- Take any medicines, including Viagra or other drugs for erectile dysfunction
- Might be pregnant

### **How the Test will Feel**

The study is done by cardiologists and a trained health care team.

You will be awake and able to follow instructions during the test.

You may feel some discomfort or pressure where the catheter is placed. You may have some discomfort from lying still during the test or from lying flat on your back after the procedure.

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

This procedure is most often done to get information about the heart or its blood vessels. It may also be done to treat some types of heart conditions, or to find out if you need heart surgery.

Your doctor may perform cardiac catheterization to diagnose or evaluate:

- Causes of congestive heart failure or cardiomyopathy
- Coronary artery disease
- Heart defects that are present at birth (congenital)
- High blood pressure in the lungs (pulmonary hypertension)
- Problems with the heart valves

The following procedures may also be done using cardiac catheterization:

- Repair certain types of heart defects
- Open a narrowed (stenotic) heart valve
- Open blocked arteries or grafts in the heart (angioplasty with or without stenting)

### **Risks**

Cardiac catheterization carries a slightly higher risk than other heart tests. However, it is very safe when done by an experienced team.

The risks include:

- Cardiac tamponade
- Heart attack
- Injury to a coronary artery
- Irregular heartbeat
- Low blood pressure
- Reaction to the contrast dye
- Stroke

Possible complications of any type of catheterization include the following:

- Bleeding, infection, and pain at the IV or sheath insertion site
- Damage to the blood vessels

- Blood clots
- Kidney damage due to the contrast dye (more common in people with diabetes or kidney problems)

## Cardiac event monitors

### Definition

A cardiac event monitor is a device that you control to record the electrical activity of your heart (ECG). This device is about the size of a pager. It records your heart rate and rhythm.

Cardiac event monitors are used when you need long-term monitoring of symptoms that occur less than daily.

### Alternative Names

Ambulatory electrocardiography; Electrocardiography (ECG) - ambulatory; Continuous electrocardiograms (EKGs); Holter monitors; Transtelephonic event monitors

### How the Test is Performed

Each type of monitor is slightly different, but they all have sensors (called electrodes) to record your ECG. In some models, these attach to the skin on your chest using sticky patches. The sensors need good contact with your skin. Poor contact can cause poor results.

You should keep your skin free from oils, creams, and sweat (as much as possible). The technician who places the monitor will perform the following to get a good ECG recording:

- Men will have the area on their chest shaved where the electrode patches will be placed.
- The area of skin where the electrodes will be attached will be cleaned with alcohol before the sensors are attached.

You can carry or wear a cardiac event monitor up to 30 days. You carry the device in your hand, wear on your wrist, or keep it in your pocket. Event monitors can be worn for weeks or until symptoms occur.

There are several types of cardiac event monitors.

- **Loop memory monitor.** The electrodes remain attached to your chest, and the monitor constantly records, but does not save, your ECG. When you feel symptoms, you press a button to activate the device. The device will then save the ECG from shortly before, during, and for a time after your symptoms begin. Some event monitors start on their own if they detect abnormal heart rhythms.
- **Symptom event monitor.** This device records your ECG only when symptoms occur, not before they occur. You carry this device in a pocket or wear it on your wrist. When you feel symptoms, you turn on the device and place the electrodes on your chest to record the ECG.
- **Patch recorders.** This monitor does not use wires or electrodes. It continuously monitors ECG activity for 14 days using an adhesive patch that sticks to the chest.
- **Implanted loop recorders.** This is a small monitor that is implanted under the skin on the chest. It can be left in place to monitor heart rhythms for 3 or more years.

While wearing the device:

- You should continue your normal activities while wearing the monitor. You may be asked to exercise or adjust your activity level during the test.
- Keep a diary of what activities you do while wearing the monitor, how you feel, and any symptoms you have. This will help your health care provider match symptoms with your monitor findings.
- The monitoring station staff will tell you how to transfer data over the telephone.
- Your provider will look at the data and see if there have been any abnormal heart rhythms.
- The monitoring company or the provider who ordered the monitor may contact you if a concerning rhythm is discovered.

While wearing the device, you may be asked to avoid certain things that can disrupt the signal between the sensors and the monitor. These may include:

- Cell phones
- Electric blankets
- Electric toothbrushes
- High-voltage areas
- Magnets

- Metal detectors

Ask the technician who attaches the device for a list of things to avoid.

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

Tell your provider if you are allergic to any tape or other adhesives.

### **How the Test will Feel**

This is a painless test. However, the adhesive of the electrode patches may irritate your skin. This goes away on its own once you remove the patches.

You must keep the monitor close to your body.

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

Most often, in people with frequent symptoms, a test called Holter monitoring, which lasts 1 to 2 days, will be performed before using a cardiac event monitor. The event monitor is ordered only if no diagnosis is reached. The event monitor is also used for people who have symptoms that occur less often, such as weekly to monthly.

Cardiac event monitoring may be used:

- To assess someone with palpitations. Palpitations are feelings that your heart is pounding or racing or beating irregularly. They can be felt in your chest, throat, or neck.
- To identify the reason for a fainting or near fainting episode.
- To diagnose heartbeats in people with risk factors for arrhythmias.
- To monitor your heart after a heart attack or when starting or stopping a heart medicine.
- To check if a pacemaker or an implantable cardioverter-defibrillator is working properly.
- To look for the cause of a stroke when the cause cannot be easily found with other tests.

### **Normal Results**

Normal variations in heart rate occur with activities. A normal result is no significant changes in heart rhythms or pattern.

### **What Abnormal Results Mean**

Abnormal results may include various arrhythmias. Changes may mean that the heart is not getting enough oxygen.

It may be used to diagnose:

- Atrial fibrillation or flutter
- Multifocal atrial tachycardia
- Paroxysmal supraventricular tachycardia
- Ventricular tachycardia
- Slow heart rate (bradycardia)
- Heart block

### **Risks**

There are no risks associated with the test, other than possible skin irritation.

## **Carotid duplex**

### **Definition**

Carotid duplex is an ultrasound test that shows how well blood is flowing through the carotid arteries. The carotid arteries are located in the neck. They supply blood directly to the brain.

### **Alternative Names**

Scan - carotid duplex; Carotid ultrasound; Carotid artery ultrasound; Ultrasound - carotid; Vascular ultrasound - carotid; Ultrasound - vascular - carotid; Stroke - carotid duplex; TIA - carotid duplex; Transient ischemic attack - carotid duplex

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

Ultrasound is a painless method that uses sound waves to create images of the inside of the body.

The test is done in a vascular lab or radiology department.

The test is done in the following way:

- You lie on your back. Your head is supported to keep it from moving. The ultrasound technician applies a water-based gel to your neck to help with the transmission of the sound waves.
- Next, the technician moves a wand called a transducer back and forth over the area.
- The device sends sound waves to the arteries in your neck. The sound waves bounce off the blood vessels and form images or pictures of the insides of the arteries.

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

No preparation is necessary.

### **How the Test will Feel**

You may feel some pressure as the transducer is moved around your neck. The pressure should not cause any pain. You may also hear a "whooshing" sound. This is normal.

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

This test checks blood flow in the carotid arteries. It can detect:

- Blood clotting (thrombosis)
- Narrowing in the arteries (stenosis)
- Other causes of blockage in the carotid arteries

Your doctor may order this test if:

- You have had a stroke or transient ischemic attack (TIA)
- You need a follow-up test because your carotid artery was found to be narrowed in the past or you have had surgery on the artery
- Your doctor hears an abnormal sound called a bruit over the carotid neck arteries. This may mean the artery is narrowed.

### **Normal Results**

The results will tell your doctor how open or narrowed your carotid arteries are. For example, the arteries may be 10% narrowed, 50% narrowed, or 75% narrowed.

A normal result means there is no problem with the blood flow in the carotid arteries. The artery is free of any significant blockage, narrowing, or other problem.

### **What Abnormal Results Mean**

An abnormal result means the artery may be narrowed, or something is changing the blood flow in the carotid arteries. This is a sign of atherosclerosis or other blood vessel conditions.

In general, the more narrowed the artery is, the higher your risk of stroke.

Depending on the results, your doctor may want you to:

- Consider surgery
- Have additional tests (such as cerebral angiography, CT angiography, and magnetic resonance angiography)
- Follow a healthy diet and lifestyle to prevent hardening of the arteries
- Repeat the test again in the future

### **Risks**

There are no risks with having this procedure.

## **Carpal tunnel biopsy**

### **Definition**

Carpal tunnel biopsy is a test in which a small piece of tissue is removed from the carpal tunnel (part of the wrist).

### **Alternative Names**

Biopsy - carpal tunnel

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

The skin of your wrist is cleansed and injected with medicine that numbs the area. Through a small cut, a sample of tissue is removed from the carpal tunnel. This is done by direct removal of tissue or by needle aspiration.

Sometimes this procedure is done at the same time as carpal tunnel release.

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

Follow instructions for not eating or drinking anything for a few hours before the test.

### **How the Test will Feel**

You may feel some stinging or burning when the numbing medicine is injected. You may also feel some pressure or tugging during the procedure. Afterward, the area may be tender or sore for a few days.

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

This test is often done to see if you have a condition called amyloidosis. It is not usually done to relieve carpal tunnel syndrome. However, a person with amyloidosis can have carpal tunnel syndrome.

Carpal tunnel syndrome is a condition in which there is excessive pressure on the median nerve. This is the nerve in the wrist that allows feeling and movement to parts of the hand. Carpal tunnel syndrome can lead to numbness, tingling, weakness, or muscle damage in the hand and fingers.

**Normal Results**

No abnormal tissues are found.

**What Abnormal Results Mean**

An abnormal result means that you have amyloidosis. Other medical treatment will be needed for this condition.

**Risks**

Risks of this procedure include:

- Bleeding
- Damage to the nerve in this area
- Infection (a slight risk any time the skin is broken)

**Catecholamine blood test****Definition**

This test measures the levels of catecholamines in the blood. Catecholamines are hormones made by the adrenal glands. The three catecholamines are epinephrine (adrenalin), norepinephrine, and dopamine.

Catecholamines are more often measured with a urine test than with a blood test.

**Alternative Names**

Norepinephrine - blood; Epinephrine - blood; Adrenalin - blood; Dopamine - blood

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

You will likely be told not to eat anything (fast) for 10 hours before the test. You may be allowed to drink water during this time.

The accuracy of the test can be affected by certain foods and medicines. Foods that can increase catecholamine levels include:

- Coffee
- Tea
- Bananas
- Chocolate
- Cocoa
- Citrus fruits
- Vanilla

You should not eat these foods for several days before the test. This is especially true if both blood and urine catecholamines are to be measured.

You should also avoid stressful situations and vigorous exercise. Both can affect the accuracy of the test results.

Medicines and substances that can increase catecholamine measurements include:

- Acetaminophen
- Albuterol
- Aminophylline
- Amphetamines
- Buspirone
- Caffeine
- Calcium channel blockers
- Cocaine
- Cyclobenzaprine
- Levodopa
- Methyl dopa
- Nicotinic acid (large doses)
- Phenoxybenzamine
- Phenothiazines
- Pseudoephedrine



- Reserpine
- Tricyclic antidepressants

Medicines that can decrease catecholamine measurements include:

- Clonidine
- Guanethidine
- MAO inhibitors

If you take any of the above medicines, check with your health care provider before the blood test about whether you should stop taking your medicine.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel slight pain. Others feel a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Catecholamines are released into the blood when a person is under physical or emotional stress. The main catecholamines are dopamine, norepinephrine, and epinephrine (which used to be called adrenalin).

This test is used to diagnose or rule out certain rare tumors, such as pheochromocytoma or neuroblastoma. It may also be done in patients with those conditions to determine if treatment is working.

#### **Normal Results**

The normal range for epinephrine is 0 to 140 pg/mL (764.3 pmol/L).

The normal range for norepinephrine is 70 to 1700 pg/mL (413.8 to 10048.7 pmol/L).

The normal range for dopamine is 0 to 30 pg/mL (195.8 pmol/L).

Note: Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Higher-than-normal levels of blood catecholamines may suggest:

- Acute anxiety
- Ganglioblastoma (very rare tumor)
- Ganglioneuroma (very rare tumor)
- Neuroblastoma (rare tumor)
- Pheochromocytoma (rare tumor)
- Severe stress

Additional conditions under which the test may be performed include multiple system atrophy.

#### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

#### **Catecholamines - urine**

##### **Definition**

Catecholamines are chemicals made by nerve tissue (including the brain) and the adrenal gland. The main types of catecholamines are dopamine, norepinephrine, and epinephrine. These chemicals break down into other components, which leave your body through your urine.

A urine test can be done to measure the level of catecholamines in your body. Separate urine tests may be done to measure related substances.

Catecholamines can also be measured with a blood test.

##### **Alternative Names**

Dopamine - urine test; Epinephrine - urine test; Adrenalin - urine test; Urine metanephrine; Normetanephrine; Norepinephrine - urine test; Urine catecholamines; VMA; HVA; Metanephrine; Homovanillic acid (HVA)

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

For this test, you must collect your urine in a special bag or container every time you urinate for 24-hour period.

- On day 1, urinate over the toilet when you wake up in the morning and discard that urine.
- Urinate into the special container every time you use the bathroom for the next 24 hours. Keep it in the refrigerator or a cool place during the collection period.
- On day 2, urinate into the container in the morning again when you wake up.
- Label the container with your name, the date, the time of completion, and return it as instructed.

For an infant, thoroughly wash the area where urine exits the body.

- Open a urine collection bag (a plastic bag with an adhesive paper on one end).
- For males, place the entire penis in the bag and attach the adhesive to the skin.
- For females, place the bag over the labia.
- Diaper as usual over the secured bag.

This procedure may take a few tries. An active baby can move the bag causing urine to go into the diaper.

Check the infant often and change the bag after the infant has urinated into it. Drain the urine from the bag into the container provided by your health care provider.

Deliver the sample to the laboratory or to your provider as soon as possible.

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

Stress and heavy exercise may affect the test results.

Some foods can increase catecholamines in your urine. You may need to avoid the following foods and beverages for several days before the test:

- Bananas
- Chocolate
- Citrus fruits
- Cocoa
- Coffee
- Licorice
- Tea
- Vanilla

Many medicines can interfere with test results.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

### **How the Test will Feel**

The test involves only normal urination, and there is no discomfort.

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

The test is usually done to diagnose an adrenal gland tumor called pheochromocytoma. It may also be used to diagnose neuroblastoma. Urine catecholamine levels are increased in most people with neuroblastoma.

The urine test for catecholamines may also be used to monitor those who are receiving treatment for these conditions.

### **Normal Results**

All of the catecholamines are broken down into inactive substances that appear in the urine:

- Dopamine becomes homovanillic acid (HVA)
- Norepinephrine becomes normetanephrine and vanillylmandelic acid (VMA)
- Epinephrine becomes metanephrine and VMA

The following normal values are the amount of the substance found in the urine over a 24-hour period:

- Dopamine: 65 to 400 micrograms (mcg)/24 hours (420 to 2612 nmol/24 hours)
- Epinephrine: 0.5 to 20 mcg/24 hours

- Metanephrine: 24 to 96 mcg/24 hours (some laboratories give the range as 140 to 785 mcg/24 hours)
- Norepinephrine: 15 to 80 mcg/24 hours (89 to 473 nmol/24 hours)
- Normetanephrine: 75 to 375 mcg/24 hours
- Total urine catecholamines: 14 to 110 mcg/24 hours
- VMA: 2 to 7 milligrams (mg)/24 hours (10 to 35 mcmol/24 hours)

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Elevated levels of urinary catecholamines may indicate:

- Acute anxiety
- Ganglioneuroblastoma (very rare)
- Ganglioneuroma (very rare)
- Neuroblastoma (rare)
- Pheochromocytoma (rare)
- Severe stress

The test may also be performed for:

- Multiple endocrine neoplasia (MEN) II

### **Risks**

There are no risks.

### **Considerations**

Several foods and drugs, as well as physical activity and stress, can affect the accuracy of this test.

### **CBC blood test**

#### **Definition**

A complete blood count (CBC) test measures the following:

- The number of red blood cells (RBC count)
- The number of white blood cells (WBC count)
- The total amount of hemoglobin in the blood
- The fraction of the blood composed of red blood cells (hematocrit)

The CBC test also provides information about the following measurements:

- Average red blood cell size (MCV)
- Hemoglobin amount per red blood cell (MCH)
- The amount of hemoglobin relative to the size of the cell (hemoglobin concentration) per red blood cell (MCHC)

The platelet count is also most often included in the CBC.

#### **Alternative Names**

Complete blood count; Anemia - CBC

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

A blood sample is needed.

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

There is no special preparation needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, you may feel moderate pain. Some people feel only a prick or stinging. Afterward there may be some throbbing or slight bruising. This soon goes away.

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

A CBC is a commonly performed lab test. It can be used to detect or monitor many different health conditions. Your health care provider may order this test:

- As part of a routine check-up
- If you are having symptoms, such as fatigue, weight loss, fever or other signs of an infection, weakness, bruising, bleeding, or any signs of cancer
- When you are receiving treatments (medicines or radiation) that may change your blood count results

- To monitor a long-term (chronic) health problem that may change your blood count results, such as chronic kidney disease

### **Normal Results**

Blood counts may vary with altitude. In general, normal results are:

RBC count:

- Male: 4.7 to 6.1 million cells/mcL
- Female: 4.2 to 5.4 million cells/mcL

WBC count:

- 4,500 to 10,000 cells/mcL

Hematocrit:

- Male: 40.7% to 50.3%
- Female: 36.1% to 44.3%

Hemoglobin:

- Male: 13.8 to 17.2 gm/dL
- Female: 12.1 to 15.1 gm/dL

Red blood cell indices:

- MCV: 80 to 95 femtoliter
- MCH: 27 to 31 pg/cell
- MCHC: 32 to 36 gm/dL

Platelet count:

- 150,000 to 450,000/dL

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

High RBC, hemoglobin, or hematocrit may be due to:

- A lack of enough water and fluids, such as from severe diarrhea, excessive sweating, or water pills used to treat high blood pressure
- Kidney disease with high erythropoietin production
- Low oxygen level in the blood for a long time, most often due to heart or lung disease
- Polycythemia vera
- Smoking

Low RBC, hemoglobin, or hematocrit is a sign of anemia, which can result from:

- Blood loss (either sudden, or from problems such as heavy menstrual periods over a long time)
- Bone marrow failure (for example, from radiation, infection, or tumor)
- Breakdown of red blood cells (hemolysis)
- Cancer and cancer treatment
- Certain long-term (chronic) medical conditions, such as chronic kidney disease, ulcerative colitis, or rheumatoid arthritis
- Leukemia
- Long-term infections such as hepatitis
- Poor diet and nutrition, causing too little iron, folate, vitamin B12, or vitamin B6
- Multiple myeloma

A lower than normal white blood cell count is called leukopenia. A decreased WBC count may be due to:

- Alcohol abuse and liver damage
- Autoimmune diseases (such as systemic lupus erythematosus)
- Bone marrow failure (for example, due to infection, tumor, radiation, or fibrosis)
- Chemotherapy medicines used to treat cancer
- Disease of the liver or spleen
- Enlarged spleen
- Infections caused by viruses, such as mono or AIDS
- Medicines

A high WBC count is called leukocytosis. It can result from:

- Certain medicines, such as corticosteroids
- Infections
- Diseases such as lupus, rheumatoid arthritis, or allergy
- Leukemia
- Severe emotional or physical stress
- Tissue damage (such as from burns or a heart attack)

A high platelet count may be due to:

- Bleeding
- Diseases such as cancer
- Iron deficiency
- Problems with the bone marrow

A low platelet count may be due to:

- Disorders where platelets are destroyed
- Pregnancy
- Enlarged spleen
- Bone marrow failure (for example, due to infection, tumor, radiation, or fibrosis)
- Chemotherapy medicines used to treat cancer

### **Risks**

There is very little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

RBCs transport hemoglobin which, in turn, carries oxygen. The amount of oxygen received by body tissues depends on the amount and function of RBCs and hemoglobin.

WBCs are mediators of inflammation and the immune response. There are various types of WBCs that normally appear in the blood:

- Neutrophils (polymorphonuclear leukocytes)
- Band cells (slightly immature neutrophils)
- T-type lymphocytes (T cells)
- B-type lymphocytes (B cells)
- Monocytes
- Eosinophils
- Basophils

### **CEA blood test**

#### **Definition**

The carcinoembryonic antigen (CEA) test measures the level of CEA in the blood. CEA is a protein normally found in the tissue of a developing baby in the womb. The blood level of this protein disappears or becomes very low after birth. In adults, an abnormal level of CEA may be a sign of cancer.

#### **Alternative Names**

Carcinoembryonic antigen blood test

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

A blood sample is needed.

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

Smoking may increase the CEA level. If you smoke, your doctor may tell you to avoid doing so for a short time before the test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is done to monitor the response to treatment and then to check for the return of colon and other cancers such as medullary thyroid cancer and cancers of the rectum, lung, breast, liver, pancreas, stomach, and ovaries.

It is not used as a screening test for cancer and should not be done unless a diagnosis of cancer has been made.

### **Normal Results**

The normal range is 0 to 2.5 ng/mL (0 to 2.5 µg/L).

In smokers, slightly higher values may be considered normal (0 to 5 ng/mL, or 0 to 5 µg/L).

### **What Abnormal Results Mean**

A high CEA level in a person recently treated for certain cancers may mean the cancer has returned. A higher than normal level may be due to the following cancers:

- Breast cancer
- Cancers of the reproductive and urinary tracts
- Colon cancer
- Lung cancer
- Pancreatic cancer
- Thyroid cancer

Higher than normal CEA level alone cannot diagnose a new cancer. Further testing is needed.

An increased CEA level may also be due to:

- Liver and gallbladder problems, such as scarring of the liver (cirrhosis), or gallbladder inflammation (cholecystitis)
- Heavy smoking
- Inflammatory bowel diseases (such as ulcerative colitis or diverticulitis)
- Lung infection
- Inflammation of the pancreas (pancreatitis)
- Stomach ulcer

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Excessive bleeding (rare)
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Cerebral angiography**

### **Definition**

Cerebral angiography is a procedure that uses a special dye (contrast material) and x-rays to see how blood flows through the brain.

### **Alternative Names**

Vertebral angiogram; Angiography - head; Carotid angiogram; Cervicocerebral catheter-based angiography; Intra-arterial digital subtraction angiography; IADSA

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

Cerebral angiography is done in the hospital or radiology center.

- You lie on an x-ray table.
- Your head is held still using a strap, tape, or sandbags, so you DO NOT move it during the procedure.
- Before the test starts, you are given a mild sedative to help you relax.
- An electrocardiogram (ECG) monitors your heart activity during the test. Sticky patches, called leads, will be placed on your arms and legs. Wires connect the leads to the ECG machine.

An area of your body, usually the groin, is cleaned and numbed with a local numbing medicine (anesthetic). A thin, hollow tube called a catheter is placed through an artery. The catheter is



carefully moved up through the main blood vessels in the belly area and chest into an artery in the neck. X-rays help the doctor guide the catheter to the correct position.

Once the catheter is in place, the dye is sent through the catheter. X-ray images are taken to see how the dye moves through the artery and blood vessels of the brain. The dye helps highlight any blockages in blood flow.

Sometimes, a computer removes the bones and tissues on the images being viewed, so that only the blood vessels filled with the dye are seen. This is called digital subtraction angiography (DSA). After the x-rays are taken, the catheter is withdrawn. Pressure is applied on the leg at the site of insertion for 10 to 15 minutes to stop the bleeding or a device is used to close the tiny hole. A tight bandage is then applied. Your leg should be kept straight for 2 to 6 hours after the procedure. Watch the area for bleeding for at least the next 12 hours. In rare cases, a wrist artery is used instead of the groin artery.

Angiography with a catheter is used less often now. This is because MRA (magnetic resonance angiography) and CT angiography give clearer images.

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

Before the procedure, your provider will examine you and order blood tests.

Tell the provider if you:

- Have a history of bleeding problems or take medicines that are blood thinners
- Have had an allergic reaction to x-ray contrast dye or any iodine substance
- May be pregnant
- Have kidney function problems

You may be told not to eat or drink anything for 4 to 8 hours before the test.

When you arrive at the testing site, you will be given a hospital gown to wear. You must remove all jewelry.

### **How the Test will Feel**

The x-ray table may feel hard and cold. You may ask for a blanket or pillow.

Some people feel a sting when the numbing medicine (anesthetic) is given. You will feel a brief, sharp pain and pressure as the catheter is moved into the body.

The contrast may cause a warm or burning feeling of the skin of the face or head. This is normal and usually goes away within a few seconds.

You may have slight tenderness and bruising at the site of the injection after the test.

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

Cerebral angiography is most often used to identify or confirm problems with the blood vessels in the brain.

Your provider may order this test if you have symptoms or signs of:

- Abnormal blood vessels in the brain (vascular malformation)
- Bulging blood vessel in the brain (aneurysm)
- Narrowing of the arteries in the brain
- Inflammation of the blood vessels in the brain (vasculitis)

It is sometimes used to:

- Look at blood flow to a tumor.
- Evaluate the arteries of the head and neck before surgery.
- Find a clot that may have caused a stroke.

In some cases, this procedure may be used to get more detailed information after something abnormal has been detected by an MRI or CT scan of the head.

This test may also be done in preparation for medical treatment (interventional radiology procedures) by way of certain blood vessels.

### **What Abnormal Results Mean**

Contrast dye flowing out of the blood vessel may be a sign of bleeding.

Narrowed arteries may suggest:

- Cholesterol deposits
- A spasm of a brain artery
- Inherited disorders

Out of place blood vessels may be due to:

- Brain tumors

- Bleeding within the skull
- Aneurysm
- Abnormal connection between the arteries and veins in the brain (arteriovenous malformation)

Abnormal results may also be due to cancer that started in another part of the body and has spread to the brain (metastatic brain tumor).

### **Risks**

Complications may include:

- Allergic reaction to the contrast dye
- Blood clot or bleeding where the catheter is inserted, which could partly block blood flow to the leg
- Damage to an artery or artery wall from the catheter, which can block blood flow and cause a stroke (rare)
- Damage to the kidneys from the IV contrast

### **Considerations**

Tell your provider right away if you have:

- Weakness in your face muscles
- Numbness in your leg during or after the procedure
- Slurred speech during or after the procedure
- Vision problems during or after the procedure

### **Cerebral spinal fluid (CSF) collection**

#### **Definition**

Cerebrospinal fluid (CSF) collection is a test to look at the fluid that surrounds the brain and spinal cord.

CSF acts as a cushion, protecting the brain and spine from injury. The fluid is normally clear. It has the same consistency as water. The test is also used to measure pressure in the spinal fluid.

#### **Alternative Names**

Spinal tap; Ventricular puncture; Lumbar puncture; Cisternal puncture; Cerebrospinal fluid culture

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

There are different ways to get a sample of CSF. Lumbar puncture (spinal tap) is the most common method.

To have the test:

- You will lie on your side with your knees pulled up toward the chest, and chin tucked downward. Sometimes the test is done sitting up, but bent forward.
- After the back is cleaned, the health care provider will inject a local numbing medicine (anesthetic) into the lower spine.
- A spinal needle will be inserted.
- An opening pressure is sometimes taken. An abnormal pressure can suggest an infection or other problem.
- Once the needle is in position, the CSF pressure is measured and a sample of 1 to 10 milliliters (mL) of CSF is collected in 4 vials.
- The needle is removed, the area is cleaned, and a bandage is placed over the needle site. You may be asked to remain lying down for a short time after the test.

In some cases, special x-rays are used to help guide the needle into position. This is called fluoroscopy.

Lumbar puncture with fluid collection may also be part of other procedures such as an x-ray or CT scan after dye has been inserted into the CSF.

Rarely, other methods of CSF collection may be used.

- Cisternal puncture uses a needle placed below the occipital bone (back of the skull). It can be dangerous because it is so close to the brain stem. It is always done with fluoroscopy.
- Ventricular puncture may be recommended in people with possible brain herniation. This is a very rarely used method. It is most often done in the operating room. A hole is drilled in the skull, and a needle is inserted directly into one of the brain's ventricles.

CSF may also be collected from a tube that is already placed in the fluid, such as a shunt or a ventricular drain.

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

You will need to give the health care team your consent before the test. Tell your provider if you are on any aspirin or any other blood-thinning medicines.

After the procedure, you should plan to rest for several hours, even if you feel fine. This is to prevent fluid from leaking around the site of the puncture. You will not need to lie flat on your back the entire time. If you develop a headache, it may be helpful to drink caffeinated beverages such as coffee, tea or soda.

### **How the Test will Feel**

It may be uncomfortable to stay in position for the test. Staying still is important because movement may lead to injury of the spinal cord.

You may be told to straighten your position slightly after the needle is in place. This is to help measure the CSF pressure.

The anesthetic will sting or burn when first injected. There will be a hard pressure sensation when the needle is inserted. Often, there is some brief pain when the needle goes through the tissue surrounding the spinal cord. This pain should stop in a few seconds.

In most cases, the procedure takes about 30 minutes. The actual pressure measurements and CSF collection only take a few minutes.

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

This test is done to measure pressures within the CSF and to collect a sample of the fluid for further testing.

CSF analysis can be used to diagnose certain neurologic disorders. These may include infections (such as meningitis) and brain or spinal cord damage. A spinal tap may also be done to establish the diagnosis of normal pressure hydrocephalus.

### **Normal Results**

Normal values typically range as follows:

- Pressure: 70 to 180 mm H<sub>2</sub>O
- Appearance: clear, colorless
- CSF total protein: 15 to 60 mg/100 mL
- Gamma globulin: 3% to 12% of the total protein
- CSF glucose: 50 to 80 mg/100 mL (or greater than two thirds of blood sugar level)
- CSF cell count: 0 to 5 white blood cells (all mononuclear), and no red blood cells
- Chloride: 110 to 125 mEq/L

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

If the CSF looks cloudy, it could mean there is an infection or a buildup of white blood cells or protein.

If the CSF looks bloody or red, it may be a sign of bleeding or spinal cord obstruction. If it is brown, orange, or yellow, it may be a sign of increased CSF protein or previous bleeding (more than 3 days ago). There may be blood in the sample that came from the spinal tap itself. This makes it harder to interpret the test results.

#### **CSF PRESSURE**

- Increased CSF pressure may be due to increased intracranial pressure (pressure within the skull).
- Decreased CSF pressure may be due to spinal block, dehydration, fainting, or CSF leakage.

#### **CSF PROTEIN**

- Increased CSF protein may be due to blood in the CSF, diabetes, polyneuritis, tumor, injury, or any inflammatory or infectious condition.
- Decreased protein is a sign of rapid CSF production.

#### **CSF GLUCOSE**

- Increased CSF glucose is a sign of high blood sugar.

- Decreased CSF glucose may be due to hypoglycemia (low blood sugar), bacterial or fungal infection (such as meningitis), tuberculosis, or certain other types of meningitis.

#### **BLOOD CELLS IN CSF**

- Increased white blood cells in the CSF may be a sign of meningitis, acute infection, beginning of a long-term (chronic) illness, tumor, abscess, or demyelinating disease (such as multiple sclerosis).
- Red blood cells in the CSF sample may be a sign of bleeding into the spinal fluid or the result of a traumatic lumbar puncture.

#### **OTHER CSF RESULTS**

- Increased CSF gamma globulin levels may be due to diseases such as multiple sclerosis, neurosyphilis, or Guillain-Barré syndrome.

Additional conditions under which the test may be performed:

- Chronic inflammatory polyneuropathy
- Dementia due to metabolic causes
- Encephalitis
- Epilepsy
- Febrile seizure (children)
- Generalized tonic-clonic seizure
- Hydrocephalus
- Inhalation anthrax
- Normal pressure hydrocephalus (NPH)
- Pituitary tumor
- Reye syndrome

#### **Risks**

Risks of lumbar puncture include:

- Bleeding into the spinal canal or around the brain (subdural hematomas).
- Discomfort during the test.
- Headache after the test that can last a few hours or days. It may be helpful to drink caffeinated beverages such as coffee, tea or soda to help relieve the headache. If headaches last more than a few days (especially when you sit, stand or walk) you might have a CSF-leak. You should talk to your physician if this occurs.
- Hypersensitivity (allergic) reaction to the anesthetic.
- Infection introduced by the needle going through the skin.

Brain herniation may occur if this test is done on a person with a mass in the brain (such as a tumor or abscess). This can result in brain damage or death. This test is not done if an exam or test reveals signs of a brain mass.

Damage to the nerves in the spinal cord may occur, particularly if the person moves during the test.

Cisternal puncture or ventricular puncture carries additional risks of brain or spinal cord damage and bleeding within the brain.

#### **Considerations**

This test is more dangerous for people with:

- A tumor in the back of the brain that is pressing down on the brainstem
- Blood clotting problems
- Low platelet count (thrombocytopenia)
- Individuals taking blood thinners, aspirin, clopidogrel, or other similar drugs to decrease the formation of blood clots.

#### **Cerebrospinal fluid (CSF) culture**

##### **Definition**

A cerebrospinal fluid (CSF) culture is a laboratory test to look for bacteria, fungi, and viruses in the fluid that moves in the space around the spinal cord. CSF protects the brain and spinal cord from injury.

##### **Alternative Names**

Culture - CSF; Spinal fluid culture; CSF culture

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

A sample of CSF is needed. This sample is usually done with a lumbar puncture, or a spinal tap. The sample is sent to the laboratory. There, it is placed in a special dish called a culture medium. Laboratory staff then observe if bacteria, fungi, or viruses grow in the dish. Growth means there is an infection.

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

Follow instructions on how to prepare for a spinal tap.

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

Your health care provider may order this test if you have signs of an infection that affects the brain or nervous system. The test helps identify what is causing the infection. This will help your provider decide on the best treatment.

#### **Normal Results**

A normal result means no bacteria, viruses, or fungi grew in the laboratory dish. This is called a negative result. However, a normal result doesn't mean that an infection is present. The spinal tap and CSF smear may need to be done again.

#### **What Abnormal Results Mean**

Bacteria or other germs found in the sample may be a sign of meningitis. This is an infection of the membranes covering the brain and spinal cord. The infection can be caused by bacteria, fungi, or viruses.

#### **Risks**

A laboratory culture poses no risk to you. Your provider will tell you about the risks of a spinal tap.

#### **Ceruloplasmin blood test**

##### **Definition**

The ceruloplasmin test measures the level of the copper-containing protein ceruloplasmin in the blood.

##### **Alternative Names**

CP - serum; Copper - ceruloplasmin

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

A blood sample is needed.

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

No special preparation is needed.

##### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Ceruloplasmin is made in the liver. Ceruloplasmin stores and transports copper in the blood to parts of the body that need it.

Your health care provider may order this test if you have signs or symptoms of a copper metabolism or copper storage disorder.

##### **Normal Results**

The normal range for adults is 14 to 40 mg/dL (0.93 to 2.65  $\mu\text{mol/L}$ ).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

##### **What Abnormal Results Mean**

A lower-than-normal ceruloplasmin levels may be due to:

- Long-term (chronic) liver disease
- Problem absorbing nutrients from food (intestinal malabsorption)
- Malnutrition
- Disorder in which cells in the body can absorb copper, but are unable to release it (Menkes syndrome)
- Group of disorders that damage the kidneys (nephrotic syndrome)
- Inherited disorder in which there is too much copper in the body's tissues (Wilson disease)

A higher-than-normal ceruloplasmin levels may be due to:

- Acute and chronic infections

- Cancer (breast or lymphoma)
- Heart disease, including heart attack
- Overactive thyroid
- Pregnancy
- Rheumatoid arthritis
- Use of birth control pills

### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Cervical MRI scan**

#### **Definition**

A cervical MRI (magnetic resonance imaging) scan uses energy from strong magnets to create pictures of the part of the spine that runs through the neck area (cervical spine).

MRI does not use radiation (x-rays).

Single MRI images are called slices. The images can be stored on a computer or printed on film.

One exam produces many images.

#### **Alternative Names**

MRI - cervical spine; MRI - neck

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

You will wear a hospital gown or clothes without metal zippers or snaps (such as sweatpants and a t-shirt). Make sure you take off your watch, jewelry and wallet. Some types of metal can cause blurry images.

You will lie on a narrow table that slides into a tunnel-shaped scanner.

Some exams use a special dye (contrast). Most of the time, you will get the dye through a vein in your arm or hand before the test. The dye can also be given through an injection. The dye helps the radiologist see certain areas more clearly.

During the MRI, the person who operates the machine will watch you from another room. The test most often lasts 30 to 60 minutes, but may take longer.

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

You may be asked not to eat or drink anything for 4 to 6 hours before the scan.

Tell your health care provider if you are afraid of closed spaces (have claustrophobia). You may be given a medicine to help you feel sleepy and less anxious. Your provider may suggest an "open" MRI, in which the machine is not as close to the body.

Before the test, tell your provider if you have:

- Brain aneurysm clips
- Certain types of artificial heart valves
- Heart defibrillator or pacemaker
- Inner ear (cochlear) implants
- Kidney disease or dialysis (you may not be able to receive contrast)
- Recently placed artificial joints
- Certain types of vascular stents
- Worked with sheet metal in the past (you may need tests to check for metal pieces in your eyes)

Because the MRI contains strong magnets, metal objects are not allowed into the room with the MRI scanner:

- Pens, pocketknives, and eyeglasses may fly across the room.
- Items such as jewelry, watches, credit cards, and hearing aids can be damaged.
- Pins, hairpins, metal zippers, and similar metallic items can distort the images.



- Removable dental work should be taken out just before the scan.

### **How the Test will Feel**

An MRI exam causes no pain. You will need to lie still. Too much movement can blur MRI images and cause errors.

The table may be hard or cold, but you can ask for a blanket or pillow. The machine makes loud thumping and humming noises when turned on. You can wear ear plugs to help block out the noise.

An intercom in the room allows you to speak to someone at any time. Some MRIs have televisions and special headphones to help the time pass.

There is no recovery time, unless you were given a medicine to relax. After an MRI scan, you can return to your normal diet, activity, and medicines.

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

The most common reasons for this test are:

- Severe neck, shoulder, or arm pain that does not get better after treatment
- Neck pain along with leg weakness, numbness, or other symptoms

A cervical MRI scan may also be done for:

- Birth defects of the spine
- Infection that involves your spine
- Injury or trauma to the spine
- Multiple sclerosis
- Severe scoliosis
- Tumor or cancer in the spine
- Arthritis in the spine

MRI works better than CT scan in diagnosing these problems most of the time.

A cervical MRI may also be done before spinal surgery.

### **Normal Results**

A normal result means the part of the spine that runs through your neck and nearby nerves appears normal.

### **What Abnormal Results Mean**

The most common reasons for an abnormal result are:

- Herniated or "slipped" disk (cervical radiculopathy)
- Narrowing of the cervical spine (spinal stenosis)
- Abnormal wear of the bones and cartilage in the neck (cervical spondylosis)

Abnormal results may also be due to:

- Degenerative changes due to age
- Bone infection (osteomyelitis)
- Disk inflammation (diskitis)
- Infection of the spine
- Multiple sclerosis
- Spinal cord injury or compression
- Spinal fracture
- Spinal tumor

Talk to your provider about your questions and concerns.

### **Risks**

MRI contains no radiation. There have been no reported side effects from the magnetic fields and radio waves.

It is also safe to have MRI performed during pregnancy. No side effects or complications have been proven.

The most common type of contrast (dye) used is gadolinium. It is very safe. Allergic reactions to the substance are rare. However, gadolinium can be harmful to people with kidney problems that need dialysis. If you have kidney problems, please tell your provider before the test.

The strong magnetic fields created during an MRI can cause heart pacemakers and other implants to not work as well. It can also cause a piece of metal inside your body to move or shift. For safety reasons, please do not bring anything that contains metal into the scanner room.

## **Cervical spine CT scan**

### **Definition**

A computed tomography (CT) scan of the cervical spine makes cross-sectional pictures of the neck. It uses x-rays to create the images.

### **Alternative Names**

CAT scan of cervical spine; Computed axial tomography scan of cervical spine; Computed tomography scan of cervical spine; CT scan of cervical spine; Neck CT scan

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

You will lie on a narrow table that slides into the center of the CT scanner.

Once you are inside the scanner, the machine's x-ray beam rotates around you. (Modern "spiral" scanners can perform the exam without stopping.)

A computer creates separate images of the body area, called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the cervical spine can be created by adding the slices together.

You must be still during the exam. Movement can cause blurred images. You may need to hold your breath for short periods of time.

The scan takes 10 to 15 minutes.

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

Some exams use a special dye, called contrast that is put into your body before the test starts.

Contrast helps certain areas show up better on the x-rays.

Contrast can be given in different ways:

- It may be given through a vein (IV) in your hand or forearm.
- It may be given as an injection into the space around the spinal cord.

If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.

Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test to avoid this problem.

Before having the contrast, tell your provider if you take the diabetes medicine metformin (Glucophage). You may need to take extra steps before the test if you take this drug.

Too much weight can cause damage to the scanner's working parts. Find out if the CT machine has a weight limit if you weigh more than 300 pounds (135 kilograms).

You will wear a hospital gown during the study. You will need to take off all jewelry.

### **How the Test will Feel**

Some people may have discomfort from lying on the hard table.

Contrast given through an IV may cause a slight burning feeling, a metal taste in the mouth, and a warm flushing of the body. These feelings are normal and go away in a few seconds.

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

CT makes detailed pictures of the body very quickly. The test may help look for:

- Birth defects of the cervical spine in children
- Spine problems, when a spine MRI cannot be used
- Injury to the upper spine
- Bone tumors and cancers
- Broken bone
- Disk herniations and compression of the spinal cord
- Healing problems or scar tissue following surgery

### **Normal Results**

Results are considered normal if the cervical spine looks OK.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Degenerative changes due to age
- Birth defects of the cervical spine
- Bone problems
- Fracture
- Osteoarthritis
- Disk herniation

- Healing problems or growth of scar tissue after surgery

### **Risks**

Risks for CT scans include:

- Being exposed to radiation
- Allergic reaction to contrast dye
- Birth defect if done during pregnancy

CT scans expose you to more radiation than regular x-rays. Having many x-rays or CT scans over time may raise your risk for cancer, but the risk from any one scan is small. Talk to your provider about this risk and how it weighs against the benefits of the test.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast given into a vein contains iodine. If a person with an iodine allergy is given this type of contrast, nausea or vomiting, sneezing, itching, or hives may occur.
- If you must have this type of contrast, you may get antihistamines (such as Benadryl) or steroids before the test.
- The kidneys help remove iodine out of the body. People with kidney disease or diabetes may need to get extra fluids after the test to help flush the iodine out of the body.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. If you have any trouble breathing during the test, you should notify the scanner operator immediately. Scanners come with an intercom and speakers, so the operator can hear you at all times.

### **Charcot foot**

#### **Definition**

Charcot foot is a condition that affects the bones, joints, and soft tissue in the feet and ankles. It can develop as a result of nerve damage in the feet due to diabetes or other nerve injuries.

#### **Alternative Names**

Charcot joint; Neuropathic arthropathy; Charcot neuropathic osteoarthropathy; Charcot arthropathy; Charcot osteoarthropathy; Diabetic Charcot foot

#### **Causes**

Charcot foot is a rare and disabling disorder. It is a result of nerve damage in the feet (peripheral neuropathy).

Diabetes is the most common cause of this type of nerve damage. This damage is more common in people with type 1 diabetes. When blood sugar levels are high over a long time, both nerve and blood vessel damage occurs in the feet.

Nerve damage makes it harder to notice the amount of pressure on the foot or if it is being stressed. The result is ongoing small injuries to the bones and ligaments that support the foot.

- You may develop bone stress fractures in your feet, yet never know it.
- Continuing to walk on the fractured bone often leads to further bone and joint damage.

Other factors leading to foot damage include:

- Blood vessel damage from diabetes can increase or change blood flow to the feet. This can lead to bone loss. Weakened bones in the feet increase the risk of fracture.
- Injury to the foot signals the body to produce more inflammation-causing chemicals. This contributes to swelling and bone loss.

### **Symptoms**

Early foot symptoms may include:

- Mild pain and discomfort
- Redness
- Swelling
- Warmth in the affected foot (noticeably warmer than the other foot)

At later stages, bones in the foot break and move out of place, causing the foot or ankle to become deformed.

- A classic sign of Charcot is rocker-bottom foot. This occurs when the bones in middle of the foot collapse. This causes the arch of the foot to collapse and bow downward.
- The toes may curl downward.

Bones that stick out at odd angles can lead to pressure sores and foot ulcers.

- Because the feet are numb, these sores may grow wider or deeper before they are noticed.
- High blood sugar also makes it hard for the body to fight infection. As a result, these foot ulcers become infected.

### **Exams and Tests**

Charcot foot is not always easy to diagnose early on. It can be mistaken for bone infection, arthritis or joint swelling. Your health care provider will take your medical history and examine your foot and ankle.

Blood tests and other lab work may be done to help rule out other causes.

Your provider may check for nerve damage with these tests:

- Electromyography
- Nerve conduction velocity tests
- Nerve biopsy

The following tests may be done to check for bone and joint damage:

- Foot X-rays
- MRI
- Bone scan

Foot x-rays may look normal at early stages of the condition. Diagnosis often comes down to recognizing early symptoms of Charcot foot: swelling, redness, and warmth of the affected foot.

### **Treatment**

The goal of treatment is to stop bone loss, allow bones to heal, and prevent bones from moving out of place (deformity).

**Immobilization.** Your provider will have you wear a total contact cast. This will help limit movement of your foot and ankle. You will likely be asked to keep your weight off your foot entirely, so you will need to use crutches, a knee-walker device, or wheelchair.

You will have new casts placed on your foot as the swelling comes down. Healing can take a couple of months or more.

**Protective footwear.** Once your foot has healed, your provider may suggest footwear to help support your foot and prevent re-injury. These may include:

- Splints
- Braces
- Orthotic insoles
- Charcot restraint orthotic walker, a special boot that provides even pressure to the whole foot

**Activity changes.** You will always be at risk for Charcot foot coming back or developing in your other foot. So your provider may recommend activity changes, such as limiting your standing or walking, to protect your feet.

**Surgery.** You may need surgery if you have foot ulcers that keep coming back or severe foot or ankle deformity. Surgery can help stabilize your foot and ankle joints and remove bony areas to prevent foot ulcers.

**Ongoing monitoring.** You will need to see your provider for checkups and take steps to protect your feet for the rest of your life.

### **Outlook (Prognosis)**

The prognosis depends on the severity of foot deformity and how well you heal. Many people do well with braces, activity changes, and ongoing monitoring.

### **Possible Complications**

Severe deformity of the foot increases the risk of foot ulcers. If ulcers become infected and hard to treat, it may require amputation.

### **When to Contact a Medical Professional**

Contact your provider if you have diabetes and your foot is warm, red, or swollen.

### **Prevention**

Healthy habits can help prevent or delay Charcot foot:

- Keep good control of your blood glucose levels to help prevent or delay Charcot foot. But it can still occur, even in people with good diabetes control.
- Take care of your feet. Check them every day.
- See your foot doctor regularly.

- Check your feet regularly to look for cuts, redness and sores.
- Avoid injuring your feet.

## **Chest CT**

### **Definition**

A chest CT (computed tomography) scan is an imaging method that uses x-rays to create cross-sectional pictures of the chest and upper abdomen.

### **Alternative Names**

Thoracic CT; CT scan - lungs; CT scan - chest

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

The test is done in the following way:

- You'll likely be asked to change into a hospital gown.
- You lie on a narrow table that slides into the center of the scanner. Once you are inside the scanner, the machine's x-ray beam rotates around you.
- You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short period of time.

The complete scan takes 30 seconds to a few minutes.

Certain CT scans require a special dye, called contrast, to be delivered into the body before the test starts. Contrast highlights specific areas inside the body and creates a clearer image. If your provider requests a CT scan with intravenous contrast, you will be given it through a vein (IV) in your arm or hand. A blood test to measure your kidney function may be done before the test. This test is to make sure your kidneys are healthy enough to filter the contrast.

You may be given medicine to help you relax during the test.

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

Some people have allergies to IV contrast and may need to take medicine before their test to safely receive this substance.

Contrast can be given in several ways, depending on the type of CT being performed.

- It may be delivered through a vein (IV) in your hand or forearm.
- It may be given through the rectum using an enema.
- You might drink the contrast before your scan. When you actually drink the contrast depends on the type of exam being done. The contrast liquid may taste chalky, although some are flavored to make them taste a little better. The contrast eventually passes out of your body through your stool.

If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.

If you weigh more than 300 pounds (135 kilograms), have your health care provider contact the scanner operator before the exam. CT scanners have an upper weight limit of 300 to 400 pounds (100 to 200 kilograms). Newer scanners can accommodate up to 600 pounds (270 kilograms).

Because it is hard for x-rays to pass through metal, you will be asked to remove jewelry.

### **How the Test will Feel**

Some people may have discomfort from lying on the hard table.

Contrast given through an IV may cause a slight burning sensation, a metallic taste in the mouth, and a warm flushing of the body. These sensations are normal and usually go away within a few seconds.

There is no recovery time, unless you were given medicine to relax. After a CT scan, you can go back to your normal diet, activity, and medicines.

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

CT quickly creates detailed pictures of the body. The test may be used to get a better view of the structures inside the chest. A CT scan is one of the best ways of looking at soft tissues such as the heart and lungs.

A chest CT may be done:

- After a chest injury
- When a tumor or mass (clump of cells) is suspected, including a solitary pulmonary nodule seen on a chest x-ray
- To determine the size, shape, and position of organs in the chest and upper abdomen
- To look for bleeding or fluid collections in the lungs or other areas

- To look for infection or inflammation in the chest
- To look for blood clots in the lungs
- To look for scarring in the lungs

### **What Abnormal Results Mean**

Thoracic CT may show many disorders of the heart, lungs, or chest area, including:

- A tear in the wall, an abnormal widening or ballooning, or narrowing of the major artery carrying blood out of the heart (aorta)
- Other abnormal changes of the major blood vessels in the lungs or chest
- Buildup of blood or fluid around the heart
- Lung cancer or cancer that has spread to the lungs from elsewhere in the body
- Collection of fluid around the lungs (pleural effusion)
- Damage to, and widening of the large airways of the lungs (bronchiectasis)
- Enlarged lymph nodes
- Lung disorders in which the lung tissues become inflamed and then damaged.
- Pneumonia
- Esophageal cancer
- Lymphoma in the chest
- Tumors, nodules, or cysts in the chest

### **Risks**

CT scans and other x-rays are strictly monitored and controlled to make sure they use the least amount of radiation. CT scans use low levels of ionizing radiation, which has the potential to cause cancer and other defects. However, the risk from any one scan is small. The risk increases as many more studies are done.

In some cases, a CT scan may still be done if the benefits greatly outweigh the risks. For example, it can be more risky to not have the exam if your provider thinks you might have cancer.

The most common type of contrast given into a vein contains iodine. If a person with an iodine allergy is given this type of contrast, nausea, sneezing, vomiting, itching, or hives may occur. In rare cases, the dye can cause a life-threatening allergic response called anaphylaxis. If you have any trouble breathing during the test, you should notify the scanner operator immediately.

Scanners come with an intercom and speakers, so the operator can hear you at all times.

In people with kidney problems, the dye may have harmful effects on the kidneys. In these situations, special steps may be taken to make the contrast dye safer to use.

### **Chest MRI**

#### **Definition**

A chest MRI (magnetic resonance imaging) scan is an imaging test that uses powerful magnetic fields and radio waves to create pictures of the chest (thoracic area). It does not use radiation (x-rays).

#### **Alternative Names**

Nuclear magnetic resonance - chest; Magnetic resonance imaging - chest; NMR - chest; MRI of the thorax; Thoracic MRI

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

The test is done in the following way:

- You may be asked to wear a hospital gown or clothing without metal fasteners (such as sweatpants and a t-shirt). Certain types of metal can cause blurry images or be dangerous to have on in the scanner room.
- You lie on a narrow table, which slides into the large tunnel-shaped scanner.
- You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods.

Some exams require a special dye called contrast. The dye is usually given before the test through a vein (IV) in your hand or forearm. The dye helps the radiologist see certain areas more clearly. A blood test to measure your kidney function may be done before the test. This is to make sure your kidneys are healthy enough to filter the contrast.

During the MRI, the person who operates the machine will watch you from another room. The test most often lasts 30 to 60 minutes, but it may take longer.

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



You may be asked not to eat or drink anything for 4 to 6 hours before the scan.

Tell your provider if you are claustrophobic (afraid of closed spaces). You may be given a medicine to help you feel sleepy and less anxious. Your provider may suggest an "open" MRI, in which the machine is not as close to your body.

Before the test, tell your health care provider if you have:

- Brain aneurysm clips
- Artificial heart valves
- Heart defibrillator or pacemaker
- Inner ear (cochlear) implants
- Kidney disease or are on dialysis (you may not be able to receive contrast)
- Recently placed artificial joints
- Vascular stents
- Worked with sheet metal in the past (you may need tests to check for metal pieces in your eyes)

The MRI contains strong magnets, so metal objects are not allowed into the room with the MRI scanner. This is because there is a risk that they will be drawn from your body toward the scanner.

Examples of metal objects you will need to remove are:

- Pens, pocket knives, and eyeglasses
- Items such as jewelry, watches, credit cards, and hearing aids
- Pins, hairpins, and metal zippers
- Removable dental work

### **How the Test will Feel**

An MRI exam causes no pain. If you have trouble lying still or are very nervous, you may be given medicine to relax you. Too much movement can blur MRI images and cause errors when the doctor looks at the images.

The table may be hard or cold, but you can ask for a blanket or pillow. The machine produces loud thumping and humming noises when turned on. You can wear ear plugs to help reduce the noise.

An intercom in the room allows you to speak to someone at any time. Some MRIs have televisions and special headphones that you can use to help the time pass.

There is no recovery time, unless you were given a medicine to relax. After an MRI scan, you can resume your normal diet, activity, and medicines.

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

A chest MRI provides detailed pictures of tissues within the chest area.

A chest MRI may be done to:

- Provide an alternative to angiography, or avoid repeated exposure to radiation
- Clarify findings from earlier x-rays or CT scans
- Diagnose abnormal growths in the chest
- Evaluate blood flow
- Show lymph nodes and blood vessels
- Show the structures of the chest from many angles
- See if cancer in the chest has spread to other areas of the body (this is called staging -- it helps guide future treatment and follow-up, and gives you an idea of what to expect in the future)
- Detect tumors

### **Normal Results**

A normal result means your chest area appears normal.

### **What Abnormal Results Mean**

An abnormal chest MRI may be due to:

- A tear in the wall, an abnormal widening or ballooning, or narrowing of the major artery carrying blood out of the heart (aorta)
- Other abnormal changes of the major blood vessels in the lungs or chest
- Buildup of blood or fluid around the heart or the lungs
- Lung cancer or cancer that has spread to the lungs from elsewhere in the body
- Cancer or tumors of the heart
- Cancer or tumors of the chest, such as a thymus tumor

- Disease in which the heart muscle becomes weakened, stretched, or has another structural problem (cardiomyopathy)
- Collection of fluid around the lungs (pleural effusion)
- Damage to, and widening of the large airways of the lungs (bronchiectasis)
- Enlarged lymph nodes
- Infection of the heart tissue or heart valve
- Esophageal cancer
- Lymphoma in the chest
- Birth defects of the heart
- Tumors, nodules, or cysts in the chest

### **Risks**

MRI uses no radiation. To date, no side effects from the magnetic fields and radio waves have been reported.

The most common type of contrast (dye) used is gadolinium. It is very safe. Allergic reactions to the substance rarely occur. However, gadolinium can be harmful to people with kidney problems who need dialysis. If you have kidney problems, tell your provider before the test.

The strong magnetic fields created during an MRI can cause heart pacemakers and other implants not to work as well. It can also cause a piece of metal inside your body to move or shift.

### **Considerations**

Currently, MRI is not considered a valuable tool for spotting or monitoring slight changes in lung tissue. The lungs contain mostly air and are hard to image. CT scan tends to be better for monitoring these changes.

Disadvantages of MRI include:

- High cost
- Long length of the scan
- Sensitivity to movement

## **Chest x-ray**

### **Definition**

A chest x-ray is an x-ray of the chest, lungs, heart, large arteries, ribs, and diaphragm.

### **Alternative Names**

Chest radiography; Serial chest x-ray; X-ray - chest

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

You stand in front of the x-ray machine. You will be told to hold your breath when the x-ray is taken.

Two images are usually taken. You will first need to stand facing the machine, and then sideways.

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

Tell the health care provider if you are pregnant. Chest x-rays are generally not done during the first 6 months of pregnancy.

### **How the Test will Feel**

There is no discomfort. The film plate may feel cold.

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

Your provider may order a chest x-ray if you have any of the following symptoms:

- A persistent cough
- Chest pain from a chest injury (with a possible rib fracture or lung complication) or from heart problems
- Coughing up blood
- Difficulty breathing
- Fever

It may also be done if you have signs of tuberculosis, lung cancer, or other chest or lung diseases.

A serial chest x-ray is one that is repeated. It may be done to monitor changes found on a past chest x-ray.

### **What Abnormal Results Mean**

Abnormal results may be due to many things, including:

In the lungs:

- Collapsed lung

- Collection of fluid around the lung
- Lung tumor (noncancerous or cancerous)
- Malformation of the blood vessels
- Pneumonia
- Scarring of lung tissue
- Tuberculosis

In the heart:

- Problems with the size or shape of the heart
- Problems with the position and shape of the large arteries
- Evidence of heart failure

In the bones:

- Fractures or other problems of the ribs and spine
- Osteoporosis

### **Risks**

There is low radiation exposure. X-rays are monitored and regulated to provide the minimum amount of radiation exposure needed to produce the image. Most experts feel that the benefits outweigh the risks. Pregnant women and children are more sensitive to the risks of x-rays.

### **Chloride - urine test**

#### **Definition**

The urine chloride test measures the amount of chloride in a certain volume of urine.

#### **Alternative Names**

Urinary chloride

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

After you provide a urine sample, it is tested in the lab. If needed, the health care provider may ask you to collect your urine at home over a period of 24 hours. Your provider will tell you how to do this. Follow instructions exactly so that the results are accurate.

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

Your provider will ask you to temporarily stop taking any medicines that may affect the test result. Tell your provider about all the medicines you take, including:

- Acetazolamide
- Corticosteroids
- Nonsteroidal anti-inflammatory drugs (NSAIDs)
- Water pills (diuretic medicines)

DO NOT stop taking any medicine before talking to your provider.

#### **How the Test will Feel**

The test involves only normal urination. There is no discomfort.

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

Your provider may order this test if you have signs of a condition that affects body fluids or acid-base balance.

#### **Normal Results**

The normal range is 110 to 250 mEq per day in a 24-hour collection. This range depends on the amount of salt and fluid you take in.

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test result.

#### **What Abnormal Results Mean**

A higher than normal urine chloride level may be due to:

- Low function of the adrenal glands
- Inflammation of the kidney that results in salt loss (salt-losing nephropathy)
- Potassium depletion (from the blood or body)
- Production of an unusually large amount of urine (polyuria)
- Too much salt in the diet

Decreased urine chloride level may be due to:

- Body holding in too much salt (sodium retention)
- Cushing syndrome

- Decreased salt intake
- Fluid loss that occurs with diarrhea, vomiting, sweating, and gastric suction
- Syndrome of inappropriate ADH secretion (SIADH)

### **Risks**

There are no risks with this test

### **Chloride test - blood**

#### **Definition**

Chloride is a type of electrolyte. It works with other electrolytes such as potassium, sodium, and carbon dioxide (CO<sub>2</sub>). These substances help keep the proper balance of body fluids and maintain the body's acid-base balance.

This article is about the laboratory test used to measure the amount of chloride in the fluid portion (serum) of the blood.

#### **Alternative Names**

Serum chloride test

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

Many medicines can interfere with blood test results.

- Your health care provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

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

You may have this test if you have signs that your body's fluid level or acid-base balance is disturbed.

This test is most often ordered with other blood tests, such as a basic or comprehensive metabolic panel.

#### **Normal Results**

A typical normal range is 96 to 106 milliequivalents per liter (mEq/L) or 96 to 106 millimoles per liter (millimol/L).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurement range for results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

A greater-than-normal level of chloride is called hyperchloremia. It may be due to:

- Addison disease
- Carbonic anhydrase inhibitors (used to treat glaucoma)
- Diarrhea
- Metabolic acidosis
- Respiratory alkalosis (compensated)
- Renal tubular acidosis

A lower-than-normal level of chloride is called hypochloremia. It may be due to:

- Bartter syndrome
- Burns
- Congestive heart failure
- Dehydration
- Excessive sweating
- Hyperaldosteronism
- Metabolic alkalosis
- Respiratory acidosis (compensated)
- Syndrome of inappropriate diuretic hormone secretion (SIADH)
- Vomiting

This test may also be done to help rule out or diagnose:

- Multiple endocrine neoplasia (MEN) II

- Primary hyperparathyroidism

## **Cholinesterase - blood**

### **Definition**

Serum cholinesterase is a blood test that looks at levels of 2 substances that help the nervous system work properly. They are called acetylcholinesterase and pseudocholinesterase. Your nerves need these substances to send signals.

Acetylcholinesterase is found in nerve tissue and red blood cells. Pseudocholinesterase is found primarily in the liver.

### **Alternative Names**

Acetylcholinesterase; RBC (or erythrocyte) cholinesterase; Pseudocholinesterase; Plasma cholinesterase; Butyrylcholinesterase; Serum cholinesterase

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

No special steps are needed to prepare for this test.

### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

Your health care provider may order this test if you may have been exposed to chemicals called organophosphates. These chemicals are used in pesticides. This test can help determine your risk of poisoning.

Less often, this test may be done:

- To diagnose liver disease
- Before you receive anesthesia with succinylcholine, which may be given before certain procedures or treatments, including electroconvulsive therapy (ECT)

### **Normal Results**

Typically, normal pseudocholinesterase values range between 8 and 18 units per milliliter (U/mL) or 8 and 18 kilounits per liter (kU/L).

Note: Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Decreased pseudocholinesterase levels may be due to:

- Chronic infection
- Chronic malnutrition
- Heart attack
- Liver damage
- Metastasis
- Obstructive jaundice
- Poisoning from organophosphates (chemicals found in some pesticides)
- Inflammation that accompanies some diseases

Smaller decreases may be due to:

- Pregnancy
- Use of birth control pills

## **Chorionic villus sampling**

### **Definition**

Chorionic villus sampling (CVS) is a test some pregnant women have to screen their baby for genetic problems.

### **Alternative Names**

CVS; Pregnancy - CVS; Genetic counseling - CVS

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

CVS can be done through the cervix (transcervical) or through the belly (transabdominal). Miscarriage rates are slightly higher when the test is done through the cervix.

The transcervical procedure is performed by inserting a thin plastic tube through the vagina and cervix to reach the placenta. Your health care provider uses ultrasound images to help guide the tube into the best area for sampling. A small sample of chorionic villus (placental) tissue is then removed.

The transabdominal procedure is performed by inserting a needle through the abdomen and uterus and into the placenta. Ultrasound is used to help guide the needle, and a small amount of tissue is drawn into the syringe.

The sample is placed in a dish and evaluated in a lab. Test results take about 2 weeks.

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

Your provider will explain the procedure, its risks, and alternative procedures such as amniocentesis.

You will be asked to sign a consent form before this procedure. You may be asked to wear a hospital gown.

The morning of the procedure, you may be asked to drink fluids and refrain from urinating. Doing so fills your bladder, which helps your provider see where to best guide the needle.

Tell your provider if you are allergic to iodine or shellfish, or if you have any other allergies.

### **How the Test will Feel**

The ultrasound does not hurt. A clear, water-based gel is applied to your skin to help with the transmission of the sound waves. A hand-held probe called a transducer is then moved over your belly area. In addition, your provider may apply pressure on your abdomen to find the position of your uterus.

The gel will feel cold at first and may irritate your skin if not washed off after the procedure.

Some women say the vaginal approach feels like a Pap test with some discomfort and a feeling of pressure. There may be a small amount of vaginal bleeding following the procedure.

An obstetrician can perform this procedure in about 5 minutes, after preparation.

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

The test is used to identify any genetic disease in your unborn baby. It is very accurate, and it can be done very early in a pregnancy.

Genetic problems can occur in any pregnancy. However, the following factors increase the risk:

- An older mother
- Past pregnancies with genetic problems
- Family history of genetic disorders

Genetic counseling is recommended before the procedure. This will allow you to make an unhurried, informed decision about options for prenatal diagnosis.

CVS can be done sooner in pregnancy than amniocentesis, most often at about 10 to 12 weeks.

CVS does not detect:

- Neural tube defects (these involve the spinal column or brain)
- Rh incompatibility (this occurs when a pregnant woman has Rh-negative blood and her unborn baby has Rh-positive blood)
- Birth defects
- Issues related to brain function, such as autism and intellectual disability

### **Normal Results**

A normal result means there are no signs of genetic defects in the developing baby. Even though the test results are very accurate, no test is 100% accurate at testing for genetic problems in a pregnancy.

### **What Abnormal Results Mean**

This test can help detect hundreds of genetic disorders. Abnormal results may be due to many different genetic conditions, including:

- Down syndrome
- Hemoglobinopathies
- Tay-Sachs disease

Talk to your provider about the meaning of your specific test results. Ask your provider:

- How the condition or defect may be treated either during or after the pregnancy
- What special needs your child may have after birth



- What other options you have about maintaining or ending your pregnancy

### **Risks**

The risks of CVS are only slightly higher than those of amniocentesis.

Possible complications include:

- Bleeding
- Infection
- Miscarriage (in up to 1 in 100 women)
- Rh incompatibility in the mother
- Rupture of membranes which may lead to miscarriage

### **Considerations**

If your blood is Rh negative, you may receive a medicine called Rho(D) immune globulin (RhoGAM and other brands) to prevent Rh incompatibility.

You will receive a follow-up ultrasound 2 to 4 days after the procedure to make sure your pregnancy is proceeding normally.

### **Chromium - blood test**

#### **Definition**

Chromium is a mineral that affects insulin, carbohydrate, fat, and protein levels in the body. This article discusses the test to check the amount of chromium in your blood.

#### **Alternative Names**

Serum chromium

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

You should stop taking mineral supplements and multivitamins for at least several days before the test. Ask your health care provider if there are other medicines you should stop taking before testing. Also, let your provider know if you have recently had contrast agents containing gadolinium or iodine as part of an imaging study. These substances can interfere with testing.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

This test may be done to diagnose chromium poisoning or deficiency.

#### **Normal Results**

Serum chromium level normally is less than or equal to 1.4 micrograms/liter (µg/L) or 26.92 nanomoles/L (nmol/L).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test result.

#### **What Abnormal Results Mean**

Increased chromium level may result if you are overexposed to the substance. This may happen if you work in the following industries:

- Leather tanning
- Electroplating
- Steel manufacturing

Decreased chromium level only occurs in people who receive all of their nutrition by vein (total parenteral nutrition or TPN) and do not get enough chromium.

#### **Considerations**

Test results may be altered if the sample is collected in a metal tube.

### **Citric acid urine test**

#### **Definition**

Citric acid urine test measures the level of citric acid in urine.

#### **Alternative Names**

Urine - citric acid test; Renal tubular acidosis - citric acid test; Kidney stones - citric acid test; Urolithiasis - citric acid test

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

You will need to collect your urine at home over 24 hours. Your health care provider will tell you how to do this. Follow instructions exactly so that the results are accurate.

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

No special preparation is necessary for this test. But the results are affected by your diet, and this test is usually done while you are on a normal diet. Ask your provider for more information.

### **How the Test will Feel**

The test involves only normal urination, and there is no discomfort.

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

The test is used to diagnose renal tubular acidosis and evaluate kidney stone disease.

### **Normal Results**

The normal range is 320 to 1,240 mg per 24 hours.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A low level of citric acid may mean renal tubular acidosis and a tendency to form calcium kidney stones.

The following may decrease urine citric acid levels:

- Long-term (chronic) kidney failure
- Diabetes
- Excessive muscle activity
- Medicines called angiotensin converting enzyme (ACE) inhibitors
- Parathyroid glands do not produce enough of its hormone (hypoparathyroidism)
- Too much acid in the body fluids (acidosis)

The following may increase urine citric acid levels:

- A high carbohydrate diet
- Estrogen therapy
- Vitamin D

### **Risks**

There are no risks with this test.

### **Clean catch urine sample**

#### **Definition**

A clean catch is a method of collecting a urine sample to be tested. The clean-catch urine method is used to prevent germs from the penis or vagina from getting into a urine sample.

#### **Alternative Names**

Urine culture - clean catch; Urinalysis - clean catch; Clean catch urine specimen; Urine collection - clean catch; UTI - clean catch; Urinary tract infection - clean catch; Cystitis - clean catch

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

If possible, collect the sample when urine has been in your bladder for 2 to 3 hours.

You will use a special kit to collect the urine. It will most likely have a cup with a lid and wipes.

Wash your hands with soap and warm water.

#### **GIRLS AND WOMEN**

Girls and women need to wash the area between the vagina "lips" (labia). You may be given a special clean-catch kit that contains sterile wipes.

- Sit on the toilet with your legs spread apart. Use two fingers to spread open your labia.
- Use the first wipe to clean the inner folds of the labia. Wipe from the front to the back.
- Use a second wipe to clean over the opening where urine comes out (urethra), just above the opening of the vagina.

To collect the urine sample:

- Keeping your labia spread open, urinate a small amount into the toilet bowl, then stop the flow of urine.
- Hold the urine cup a few inches (or a few centimeters) from the urethra and urinate until the cup is about half full.
- You may finish urinating into the toilet bowl.

#### **BOYS AND MEN**

Clean the head of the penis with a sterile wipe. If you are not circumcised, you will need to pull back (retract) the foreskin first.

- Urinate a small amount into the toilet bowl, and then stop the flow of urine.
- Then collect a sample of urine into the clean or sterile cup, until it is half full.
- You may finish urinating into the toilet bowl.

#### INFANTS

You will be given a special bag to collect the urine. It will be a plastic bag with a sticky strip on one end, made to fit over your baby's genital area.

If the collection is being taken from an infant, you may need extra collection bags.

Wash the area well with soap and water, and dry. Open and place the bag on your infant.

- For boys, the entire penis can be placed in the bag.
- For girls, place the bag over the labia.

You can put on a diaper over the bag.

Check the baby often and remove the bag after the urine collects in it. Active infants may displace the bag, so you may need to make more than one attempt. Drain the urine into the container you were given and return it to the health care provider as directed.

#### AFTER COLLECTING THE SAMPLE

Screw the lid tightly on the cup. Do not touch the inside of the cup or the lid.

- Return the sample to the provider.
- If you are at home, place the cup in a plastic bag and put the bag in the refrigerator until you take it to the lab or your provider's office.

#### CMV blood test

##### Definition

The CMV blood test determines the presence of substances (proteins) called antibodies to a virus called cytomegalovirus (CMV) in the blood.

##### Alternative Names

CMV antibody tests

##### How the Test is Performed

A blood sample is needed.

##### How to Prepare for the Test

There is no special preparation for the test.

##### How the Test will Feel

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

##### Why the Test is Performed

CMV infection is a disease caused by a type of herpes virus.

The CMV blood test is performed to detect current active CMV infection, or past CMV infection in people who are at risk for reactivation of infection. These people include organ transplant recipients and those with a suppressed immune system. The test may also be performed to detect CMV infection in newborns.

##### Normal Results

People who have never been infected with CMV have no detectable antibodies to CMV.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

##### What Abnormal Results Mean

The presence of antibodies to CMV indicates a current or past infection with CMV. If the number of antibodies (called the antibody titer) rises over a few weeks, it may mean that you have a current or recent infection.

Long-term (chronic) CMV infection (in which the antibody count stays about the same over time) can reactivate in a person with a suppressed immune system.

##### Risks

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

To detect a blood or organ infection with CMV, the provider can test for the presence of CMV itself in the blood or a specific organ.

### **CO2 blood test**

#### **Definition**

CO2 is carbon dioxide. This article discusses the laboratory test to measure the amount of carbon dioxide in the liquid part of your blood, called the serum.

In the body, most of the CO2 is in the form of a substance called bicarbonate ( $\text{HCO}_3^-$ ). Therefore, the CO2 blood test is really a measure of your blood bicarbonate level.

#### **Alternative Names**

Bicarbonate test;  $\text{HCO}_3^-$ ; Carbon dioxide test; TCO2; Total CO2; CO2 test - serum; Acidosis - CO2; Alkalosis - CO2

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

A blood sample is needed. Most of the time blood is drawn from a vein located on the inside of the elbow or the back of the hand.

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

Many medicines can interfere with blood test results.

- Your health care provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

#### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

The CO2 test is most often done as part of an electrolyte or basic metabolic panel. Changes in your CO2 level may suggest that you are losing or retaining fluid. This may cause an imbalance in your body's electrolytes.

CO2 levels in the blood are affected by kidney and lung function. The kidneys help maintain the normal bicarbonate levels.

#### **Normal Results**

The normal range is 23 to 29 milliequivalents per liter (mEq/L) or 23 to 29 millimoles per liter (mmol/L).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurement range of results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

Abnormal levels may be due to the following problems.

Lower-than-normal levels:

- Addison disease
- Diarrhea
- Ethylene glycol poisoning
- Ketoacidosis
- Kidney disease
- Lactic acidosis
- Metabolic acidosis

- Methanol poisoning
- Renal tubular acidosis; distal
- Renal tubular acidosis; proximal
- Respiratory alkalosis (compensated)
- Salicylate toxicity (such as aspirin overdose)
- Ureteral diversion

Higher-than-normal levels:

- Bartter syndrome
- Cushing syndrome
- Hyperaldosteronism
- Metabolic alkalosis
- Respiratory acidosis (compensated)
- Vomiting

Delirium may also alter bicarbonate levels.

### **Coccidioides complement fixation**

#### **Definition**

Coccidioides complement fixation is a blood test that looks for substances (proteins) called antibodies, which are produced by the body in reaction to the fungus *Coccidioides immitis*. This fungus causes the disease coccidioidomycosis.

#### **Alternative Names**

Coccidioides antibody test; Coccidioidomycosis blood test

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

A blood sample is needed.

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

There is no special preparation for the test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain, while others feel only a prick or stinging. Afterward, there may be some throbbing.

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

This test is used to detect infection with the fungus that causes coccidioidomycosis, or valley fever. This condition can cause lung or widespread (disseminated) infection.

#### **Normal Results**

A normal result means no *Coccidioides immitis* antibodies are detected in the blood sample. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results mean that *Coccidioides immitis* antibodies are present. This can mean that you have a current or past infection.

The test may be repeated after several weeks to detect a rise in titer (antibody concentration), which confirms an active infection.

In general, the worse the infection, the higher is the titer, except in people with a weakened immune system.

There can be false positive tests in people with other fungal diseases such as histoplasmosis and blastomycosis, and false negative tests in people with single lung masses from coccidioidomycosis.

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)

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

### **Coccidioides precipitin test**

#### **Definition**

Coccidioides precipitin is a blood test that looks for infections due to a fungus called coccidioides, which causes the disease coccidioidomycosis or valley fever.

#### **Alternative Names**

Coccidioidomycosis antibody test; Coccidioides blood test; Valley fever blood test

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

A blood sample is needed.

The sample is sent to a laboratory. There, it is examined for bands called precipitin that form when specific antibodies are present.

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

There is no special preparation for the test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or bruising. This soon goes away.

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

The precipitin test is one of several tests that can be done to determine if you are infected with coccidioides, which causes the disease coccidioidomycosis.

Antibodies are specialized proteins that defend the body against bacteria, viruses, and fungi. These and other foreign substances are called antigens. When you are exposed to antigens, your body produces antibodies.

The precipitin test helps check if the body has produced antibodies to a specific antigen, in this case, the coccidioides fungus.

#### **Normal Results**

A normal result is when no precipitins are formed. This means the blood test did not detect the antibody to coccidioides.

#### **What Abnormal Results Mean**

An abnormal (positive) result means the antibody to coccidioides has been detected.

In this case, another test is done to confirm that you have an infection. Your doctor can tell you more.

During the early stage of an illness, few antibodies may be detected. Antibody production increases during the course of an infection. For this reason, this test may be repeated several weeks after the first test.

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Cologuard**

#### **Definition**

Cologuard is a screening test for colon and rectal cancer.

The colon sheds cells from its lining every day. These cells pass with the stool through the colon. The cancer cells may have DNA changes in certain genes. Cologuard detects the altered DNA. The presence of abnormal cells or blood in the stool may indicate cancer or precancer tumors.

#### **Alternative Names**

Cologuard; Colon cancer screening - Cologuard; Stool DNA test - Cologuard; FIT-DNA stool test; Colon precancer screening - Cologuard

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



The Cologuard testing kit for colon and rectal cancer must be ordered by your health care provider. It will be sent by mail to your address. You collect the sample at home and send it back to the lab for testing.

The Cologuard testing kit will contain a sample container, a tube, preserving liquid, labels and instructions on how to collect the sample. When you are ready to have a bowel movement, use the Cologuard testing kit to collect your stool sample.

Read the instructions that come with the testing kit carefully. Wait until you are ready to have a bowel movement. Collect the sample only when it is possible to ship it within 24 hours. The sample must reach the lab in 72 hours (3 days).

DO NOT collect the sample if:

- You have diarrhea.
- You are menstruating.
- You have rectal bleeding due to hemorrhoids.

Follow these steps to collect the sample:

- Read all instructions that come with the kit.
- Use the brackets provided with the testing kit to fix the sample container on your toilet seat.
- Use the toilet as usual for your bowel movement.
- Try not to let urine get into the sample container.
- Do not put toilet paper into the sample container.
- Once your bowel movement is over, remove the sample container from the brackets and keep it on a flat surface.
- Follow instructions to collect a little sample in the tube provided with the testing kit.
- Pour the preserving liquid in the sample container and close the lid tightly.
- Label the tubes and the sample container according to the instructions, and place them in the box.
- Store the box at room temperature, away from direct sunlight and heat.
- Ship the box within 24 hours to the lab using the label provided.

The results of the test will be sent to your provider in two weeks.

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

The Cologuard test does not require any preparation. You do not need to change your diet or medicines before the test.

### **How the Test will Feel**

The test requires you to have a normal bowel movement. It will not feel any different from your regular bowel movements. You can collect the sample at your home privately.

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

The test is done to screen for colon and rectal cancer and abnormal growths (polyps) in the colon or rectum.

Your provider may suggest Cologuard testing once every 3 years after age 50 years. The test is recommended if you are between ages 50 to 75 years and have an average risk of colon cancer.

This means that you do not have:

- Personal history of colon polyps and colon cancer
- Family history of colon cancer
- Inflammatory bowel disease (Crohn disease, ulcerative colitis)

### **Normal Results**

The normal result (negative result) will indicate that:

- The test did not detect blood cells or altered DNA in your stool.
- You do not need further testing for colon cancer if you have an average risk of colon or rectal cancer.

### **What Abnormal Results Mean**

Abnormal result (positive result) suggests that the test found some pre-cancer or cancer cells in your stool sample. However, the Cologuard test does not diagnose cancer. You will need further tests to make a diagnosis of cancer. Your provider will likely suggest a colonoscopy.

### **Risks**

There is no risk involved in taking the sample for Cologuard test.

Screening tests carry a small risk of:

- False-positives (your test results are abnormal, but you do NOT have colon cancer or pre-malignant polyps)
- False-negatives (your test is normal even when you have colon cancer)

### **Considerations**

It is unclear yet whether the use of Cologuard will lead to better outcomes compared with other methods used to screen for colon and rectal cancer.

### **Definition**

A colonoscopy is an exam that views the inside of the colon (large intestine) and rectum, using a tool called a colonoscope.

The colonoscope has a small camera attached to a flexible tube that can reach the length of the colon.

### **Alternative Names**

Colon cancer - colonoscopy; Colorectal cancer - colonoscopy; Colonoscopy - screening; Colon polyps - colonoscopy; Ulcerative colitis - colonoscopy; Crohn disease - colonoscopy; Diverticulitis - colonoscopy; Diarrhea - colonoscopy; Anemia - colonoscopy; Blood in stool - colonoscopy

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

Colonoscopy is done most often in a procedure room at your doctor's office. It can also be done in the outpatient department of a hospital or medical center.

- You will be asked to change out of your street clothes and wear a hospital gown for the procedure.
- You will likely be given medicine into a vein (IV) to help you relax. You should not feel any pain. You may be awake during the test and may even be able to speak. You will probably not remember anything.
- You lie on your left side with your knees drawn up toward your chest.
- The scope is gently inserted through the anus. It is carefully moved into the beginning of the large intestine. The scope is slowly advanced as far as the lowest part of the small intestine.
- Air is inserted through the scope to provide a better view. Suction may be used to remove fluid or stool.
- The doctor gets a better view as the scope is moved back out. So, a more careful exam is done while the scope is being pulled back.
- Tissue samples (biopsy) or polyps may be removed using tiny tools inserted through the scope. Photos may be taken using the camera at the end of the scope. If needed, procedures, such as laser therapy, are also done.

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

Your bowel needs to be completely empty and clean for the exam. A problem in your large intestine that needs to be treated may be missed if your intestines are not cleaned out.

Your health care provider will give you the steps for cleansing your bowel. This is called bowel preparation. Steps may include:

- Using enemas
- Not eating solid foods for 1 to 3 days before the test
- Taking laxatives

You need to drink plenty of clear liquids for 1 to 3 days before the test. Examples of clear liquids are:

- Clear coffee or tea
- Fat-free bouillon or broth
- Gelatin
- Sports drinks without added color
- Strained fruit juices
- Water

You will likely be told to stop taking aspirin, ibuprofen, naproxen, or other blood-thinning medicines for several days before the test. Keep taking your other medicines unless your doctor tells you otherwise.

You will need to stop taking iron pills or liquids a few days before the test, unless your provider tells you it is OK to continue. Iron can make your stool dark black. This makes it harder for the doctor to view inside your bowel.

### **How the Test will Feel**

The medicines will make you sleepy so that you may not feel any discomfort or have any memory of the test.

You may feel pressure as the scope moves inside. You may feel brief cramping and gas pains as air is inserted or the scope advances. Passing gas is necessary and should be expected.

After the exam, you may have mild abdominal cramping and pass a lot of gas. You may also feel bloated and sick to your stomach. These feelings will soon go away.

You should be able to go home about one hour after the test. You must plan to have someone take you home after the test, because you will be woozy and unable to drive. The providers will not let you leave until someone arrives to help you.

When you are home, follow instructions on recovering from the procedure. These may include:

- Drink plenty of liquids. Eat a healthy meal to restore your energy.
- You should be able to return to your regular activities the next day.
- Avoid driving, operating machinery, drinking alcohol, and making important decisions for at least 24 hours after the test.

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

Colonoscopy may be done for the following reasons:

- Abdominal pain, changes in bowel movements, or weight loss
- Abnormal changes (polyps) found on sigmoidoscopy or x-ray tests (CT scan or barium enema)
- Anemia due to low iron (usually when no other cause has been found)
- Blood in the stool, or black, tarry stools
- Follow-up of a past finding, such as polyps or colon cancer
- Inflammatory bowel disease (ulcerative colitis and Crohn disease)
- Screening for colorectal cancer

### **Normal Results**

Normal findings are healthy intestinal tissues.

### **What Abnormal Results Mean**

Abnormal test results may mean any of the following:

- Abnormal pouches on the lining of the intestines, called diverticulosis
- Areas of bleeding
- Cancer in the colon or rectum
- Colitis (a swollen and inflamed intestine) due to Crohn disease, ulcerative colitis, infection, or lack of blood flow
- Small growths called polyps on the lining of your colon (which can be removed through the colonoscope during the exam)

### **Risks**

Risks of colonoscopy may include any of the following:

- Heavy or ongoing bleeding from biopsy or removal of polyps
- Hole or tear in the wall of the colon that requires surgery to repair
- Infection needing antibiotic therapy (very rare)
- Reaction to the medicine you are given to relax, causing breathing problems or low blood pressure

### **Color vision test**

#### **Definition**

A color vision test checks your ability to distinguish between different colors.

#### **Alternative Names**

Eye test - color; Vision test - color; Ishihara color vision test

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

You will sit in a comfortable position in regular lighting. The health care provider will explain the test to you.

You will be shown several cards with colored dot patterns. These cards are called Ishihara plates. In the patterns, some of the dots will appear to form numbers or symbols. You will be asked to identify the symbols, if possible.

As you cover one eye, the tester will hold the cards 14 inches (35 centimeters) from your face and ask you to quickly identify the symbol found in each color pattern.

Depending on the problem suspected, you may be asked to determine the intensity of a color, particularly in one eye compared to the other. This is often tested by using the cap of a red eyedrop bottle.

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

If your child is having this test performed, it may be helpful to explain how the test will feel, and to practice or demonstrate on a doll. Your child will feel less anxious about the test if you explain what will happen and why.

Usually there is a sample card of multicolored dots that almost everyone can identify, even people with color vision problems.

If you or your child normally wears glasses, wear them during the test.

Small children may be asked to tell the difference between a red bottle cap and caps of a different color.

### **How the Test will Feel**

The test is similar to a vision test.

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

This test is done to determine whether you have any problems with your color vision.

Color vision problems often fall into two categories:

- Present from birth (congenital) problems in the light-sensitive cells (cones) of the retina (the light-sensitive layer at the back of the eye) -- the color cards are used in this case.
- Diseases of the optic nerve (the nerve that carries visual information from the eye to the brain) -- the bottle caps are used in this case.

### **Normal Results**

Normally, you will be able to distinguish all colors.

### **What Abnormal Results Mean**

This test can determine the following congenital (present from birth) color vision problems:

- Achromatopsia -- complete color blindness, seeing only shades of gray
- Deuteranopia -- difficulty telling the difference between red/purple and green/purple
- Protanopia -- difficulty telling the difference between blue/green and red/green
- Tritanopia -- difficulty telling the difference between yellow/green and blue/green

Problems in the optic nerve can show up as a loss of color intensity, although the color card test may be normal.

### **Risks**

There are no risks with this test.

### **Colposcopy - directed biopsy**

#### **Definition**

A colposcopy is a special way of looking at the cervix. It uses a light and a low-powered microscope to make the cervix appear much larger. This helps your health care provider find and then biopsy abnormal areas in your cervix.

#### **Alternative Names**

Biopsy - colposcopy - directed; Biopsy - cervix - colposcopy; Endocervical curettage; ECC; Cervical punch biopsy; Biopsy - cervical punch; Cervical biopsy; Cervical intraepithelial neoplasia - colposcopy; CIN - colposcopy; Precancerous changes of the cervix - colposcopy; Cervical cancer - colposcopy; Squamous intraepithelial lesion - colposcopy; LSIL - colposcopy; HSIL - colposcopy; Low-grade colposcopy; High-grade colposcopy; Carcinoma in situ - colposcopy; CIS - colposcopy; ASCUS - colposcopy; Atypical glandular cells - colposcopy; AGUS - colposcopy; Atypical squamous cells - colposcopy; Pap smear - colposcopy; HPV - colposcopy; Human papilloma virus - colposcopy; Cervix - colposcopy; Colposcopy

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

You will lie on a table and place your feet in stirrups, to position your pelvis for exam. The provider will place an instrument (called a speculum) into your vagina to see the cervix clearly. The cervix and vagina are gently cleaned with a vinegar or iodine solution. This removes the mucus that covers the surface and highlights abnormal areas.

The provider will place the colposcope at the opening of the vagina and examine the area.

Photographs may be taken. The colposcope does not touch you.

If any areas look abnormal, a small sample of the tissue will be removed using small biopsy tools.

Many samples may be taken. Sometimes a tissue sample from inside the cervix is removed. This is called endocervical curettage (ECC).

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

There is no special preparation. You may be more comfortable if you empty your bladder and bowel before the procedure.

Before the exam:

- Do not douche (this is never recommended).
- Do not place any products into the vagina.
- Do not have sex for 24 hours before the exam.
- Tell your provider if you are pregnant or could be pregnant.

This test should not be done during a heavy period, unless it is abnormal. Keep your appointment if you are:

- At the very end or beginning of your regular period
- Having abnormal bleeding

You may be able to take ibuprofen or acetaminophen (Tylenol) before the colposcopy. Ask your provider if this is OK, and when and how much you should take.

### **How the Test will Feel**

You may have some discomfort when the speculum is placed inside the vagina. It may be more uncomfortable than a regular Pap test.

- Some women feel a slight sting from the cleansing solution.
- You may feel a pinch or cramp each time a tissue sample is taken.
- You may have some cramping or slight bleeding after the biopsy.
- Do not use tampons or put anything in the vagina for several days after a biopsy.

Some women may hold their breath during pelvic procedures because they expect pain. Slow, regular breathing will help you relax and relieve pain. Ask your provider about bringing a support person with you if that will help.

You may have some bleeding after the biopsy, for about 2 days.

- You should not douche, place tampons or creams into the vagina, or have sex for up to a week afterward. Ask your provider how long you should wait.
- You can use sanitary pads.

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

Colposcopy is done to detect cervical cancer and changes that may lead to cervical cancer.

It is most often done when you have had an abnormal Pap smear or HPV test. It may also be recommended if you have bleeding after sexual intercourse.

Colposcopy may also be done when your provider sees abnormal areas on your cervix during a pelvic exam. These may include:

- Any abnormal growth on the cervix, or elsewhere in the vagina
- Genital warts or HPV
- Irritation or inflammation of the cervix (cervicitis)

The colposcopy may be used to keep track of HPV, and to look for abnormal changes that can come back after treatment.

### **Normal Results**

A smooth, pink surface of the cervix is normal.

A specialist called a pathologist will examine the tissue sample from the cervical biopsy and send a report to your doctor. Biopsy results most often take 1 to 2 weeks. A normal result means there is no cancer and no abnormal changes were seen.

### **What Abnormal Results Mean**

Your provider should be able to tell you if anything abnormal was seen during the test, including:

- Abnormal patterns in the blood vessels
- Areas that are swollen, worn away, or wasted away (atrophic)
- Cervical polyps
- Genital warts
- Whitish patches on the cervix

Abnormal biopsy results may be due to changes that can lead to cervical cancer. These changes are called dysplasia, or cervical intraepithelial neoplasia (CIN).

- CIN I is mild dysplasia
- CIN II is moderate dysplasia
- CIN III is severe dysplasia or very early cervical cancer called carcinoma in situ

Abnormal biopsy results may be due to:

- Cervical cancer
- Cervical intraepithelial neoplasia (precancerous tissue changes that are also called cervical dysplasia)
- Cervical warts (infection with human papilloma virus, or HPV)

If the biopsy does not determine the cause of abnormal results, you may need a procedure called a cold knife cone biopsy.

### **Risks**

After the biopsy, you may have some bleeding for up to a week. You may have mild cramping, your vagina may feel sore, and you may have a dark discharge for 1 to 3 days.

A colposcopy and biopsy will not make it more difficult for you to become pregnant, or cause problems during pregnancy.

Call your provider right away if:

- Bleeding is very heavy or lasts for longer than 2 weeks.
- You have pain in your belly or in the pelvic area.
- You notice any signs of infection (fever, foul odor, or discharge).

### **Complement**

#### **Definition**

Complement is a blood test that measures the activity of certain proteins in the liquid portion of your blood.

The complement system is a group of nearly 60 proteins that are in blood plasma or on the surface of some cells. The proteins work with your immune system and play a role to protect the body from infections, and to remove dead cells and foreign material. Rarely, people may inherit deficiency of some complement proteins. These people are prone to certain infections or autoimmune disorders.

There are nine major complement proteins. They are labeled C1 through C9. This article describes the test that measures total complement activity.

#### **Alternative Names**

Complement assay; Complement proteins

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

A blood sample is needed. This is most often taken through a vein. The procedure is called a venipuncture.

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

There is no special preparation.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel slight pain. Others may feel only a prick or sting. Afterward, there may be some throbbing.

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

Total complement activity (CH50, CH100) looks at the overall activity of the complement system. In most cases, other tests that are more specific for the suspected disease are done first. C3 and C4 are the complement components measured most often.

A complement test may be used to monitor people with an autoimmune disorder. It is also used to see if treatment for their condition is working. For example, people with active lupus erythematosus may have lower-than-normal levels of the complement proteins C3 and C4.



Complement activity varies throughout the body. For example, in people with rheumatoid arthritis, complement activity in the blood may be normal or higher-than-normal, but much lower-than-normal in the joint fluid.

People with some bacterial blood infections and shock often have very low C3 and components of what's known as the alternative pathway. C3 is often also low in fungal infections and some parasitic infections such as malaria.

### **Normal Results**

The normal results for this test are:

- Total blood complement level: 41 to 90 hemolytic units
- C1 level: 14.9 to 22.1 mg/dL
- C3 levels: 88 to 201 mg/dL
- C4 levels: 15 to 45 mg/dL

Note: mg/dL = milligrams per deciliter.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Increased complement activity may be seen in:

- Cancer
- Certain infections
- Ulcerative colitis

Decreased complement activity may be seen in:

- Cirrhosis
- Glomerulonephritis
- Hereditary angioedema
- Hepatitis
- Kidney transplant rejection
- Lupus nephritis
- Malnutrition
- Systemic lupus erythematosus
- Rare inherited complement deficiencies

### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

The "complement cascade" is a series of reactions that take place in the blood. The cascade activates the complement proteins. The result is an attack unit that creates holes in the membrane of bacteria, killing them.

### **Complement component 3 (C3)**

#### **Definition**

Complement C3 is a blood test that measures the activity of a certain protein.

This protein is part of the complement system. The complement system is a group of nearly 60 proteins that are in blood plasma or on the surface of some cells. The proteins work with your immune system and play a role to protect the body from infections, and to remove dead cells and foreign material. Rarely, people may inherit deficiency of some complement proteins. These people are prone to certain infections or autoimmune disorders.

There are nine major complement proteins. They are labeled C1 through C9. This article describes the test that measures C3.

#### **Alternative Names**

C3

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

Blood is drawn from a vein. Most often, a vein from the inside of the elbow or the back of the hand is used.

The procedure is as follows:

- The site is cleaned with an antiseptic.
- The health care provider wraps an elastic band around the upper arm to apply pressure to the area and make the vein swell with blood.
- The provider gently inserts a needle into the vein.
- The blood collects into an airtight vial or tube attached to the needle. The elastic band is removed from your arm.
- Once the blood has been collected, the needle is removed. The puncture site is covered to stop any bleeding.

In infants or young children, a sharp tool called a lancet may be used to puncture the skin and make it bleed. The blood collects into a small glass tube called a pipette, or onto a slide or test strip. A bandage may be placed over the area if there is any bleeding.

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

There is no special preparation needed.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

C3 and C4 are the most commonly measured complement components.

A complement test may be used to monitor people with an autoimmune disorder. It is done to see if treatment for their condition is working. When the complement system is turned on during inflammation, levels of complement proteins may go down. For example, people with active lupus erythematosus may have lower-than-normal levels of the complement proteins C3 and C4.

Complement activity varies throughout the body. For example, in people with rheumatoid arthritis, complement activity in the blood may be normal or higher-than-normal, but much lower-than-normal in the joint fluid.

The test may also be done for the following conditions:

- Fungal infections
- Gram negative septicemia
- Parasitic infections, such as malaria
- Paroxysmal nocturnal hemoglobinuria (PNH)
- Shock

### **Normal Results**

The normal range is 88 to 201 milligrams per deciliter (mg/dL) (0.88 to 2.01 g/L).

Note: Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Increased complement activity may be seen in:

- Cancer
- Ulcerative colitis

Decreased complement activity may be seen in:

- Bacterial infections (especially Neisseria)
- Cirrhosis
- Glomerulonephritis
- Hepatitis
- Hereditary angioedema
- Kidney transplant rejection
- Lupus nephritis
- Malnutrition
- Systemic lupus erythematosus

- Rare inherited complement deficiencies

### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

The complement cascade is a series of reactions that take place in the blood. The cascade activates the complement proteins. The result is an attack unit that creates holes in the membrane of bacteria, killing them. C3 attaches to bacteria and kills them directly.

### **Complement component 4**

#### **Definition**

Complement component 4 is a blood test that measures the activity of a certain protein. This protein is part of the complement system. The complement system is a group of nearly 60 proteins that are found in the blood plasma or on the surface of some cells.

The proteins work with your immune system and play a role in protecting from infection. They also help to remove dead cells and foreign material from the body. Rarely, people may inherit deficiency of some complement proteins. These people are prone to certain infections or autoimmune disorders.

There are nine major complement proteins. They are labeled C1 through C9. This article describes the test that measures C4.

#### **Alternative Names**

C4

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

Blood is drawn from a vein. A vein from the inside of the elbow or the back of the hand is most often used.

The procedure is as follows:

- The site is cleaned with an antiseptic.
- The health care provider wraps an elastic band around the upper arm to apply pressure to the area and make the vein swell with blood.
- The provider gently inserts a needle into the vein.
- The blood collects into an airtight vial or tube attached to the needle. The elastic band is removed from your arm.
- Once the blood has been collected, the needle is removed. The puncture site is covered to stop any bleeding.

In infants or young children, a sharp tool called a lancet may be used to puncture the skin and make it bleed. The blood collects into a small glass tube called a pipette, or onto a slide or test strip. A bandage may be placed over the area if there is any bleeding.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

C3 and C4 are the most commonly measured complement components. When the complement system is turned on during inflammation, levels of complement proteins may go down.

Complement activity may be measured to determine how severe a disease is or if treatment is working.

A complement test may be used to monitor people with an autoimmune disorder. For example, people with active systemic lupus erythematosus may have lower-than-normal levels of the complement proteins C3 and C4.

Complement activity varies throughout the body. In people with rheumatoid arthritis, complement activity may be normal or higher-than-normal in the blood, but much lower-than-normal in the joint fluid.

#### **Normal Results**

Normal ranges for C4 is 15 to 45 milligrams per deciliter (mg/dL) (0.15 to 0.45 g/L).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

Increased complement activity may be seen in:

- Cancer
- Ulcerative colitis

Decreased complement activity may be seen in:

- Bacterial infections (especially *Neisseria*)
- Cirrhosis
- Glomerulonephritis
- Hepatitis
- Hereditary angioedema
- Kidney transplant rejection
- Lupus nephritis
- Malnutrition
- Systemic lupus erythematosus
- Rare inherited complement deficiencies

#### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

#### **Complement fixation test to *C burnetii***

##### **Definition**

The complement fixation test to *Coxiella burnetii* (*C burnetii*) is a blood test that checks for infection due to bacteria called *C burnetii*, which causes Q fever.

##### **Alternative Names**

Q fever - complement fixation test; *Coxiella burnetii* - complement fixation test; *C burnetii* - complement fixation test

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

A blood sample is needed.

The sample is sent to a laboratory. There, a method called complement fixation is used to check if the body has produced substances called antibodies to a specific foreign substance (antigen), in this case, *C burnetii*. Antibodies defend the body against bacteria, viruses, and fungi. If the antibodies are present, they stick, or "fix" themselves, to the antigen. This is why the test is called "fixation."

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

No special preparation is necessary for this test.

##### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or bruising. This soon goes away.

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

This test is done to detect Q fever.

##### **Normal Results**

Absence of antibodies to *C burnetii* is normal. It means you do not have Q fever now or in the past.

##### **What Abnormal Results Mean**

An abnormal result means you have a current infection with *C burnetii*, or that you have been exposed to the bacteria in the past. People with past exposure may have antibodies, even if they are not aware that they were exposed. Further testing may be needed to distinguish between current, previous, and long-term (chronic) infection.

During the early stage of an illness, few antibodies may be detected. Antibody production increases during the course of an infection. For this reason, this test may be repeated several weeks after the first test.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Comprehensive metabolic panel**

#### **Definition**

A comprehensive metabolic panel is a group of blood tests. They provide an overall picture of your body's chemical balance and metabolism. Metabolism refers to all the physical and chemical processes in the body that use energy.

#### **Alternative Names**

Metabolic panel - comprehensive; CMP

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

A blood sample is needed.

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

You should not eat or drink for 8 hours before the test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test gives your health care provider information about:

- How your kidneys and liver are working
- Blood sugar and calcium levels
- Sodium, potassium, and chloride levels (called electrolytes)
- Protein levels

Your provider may order this test to check you for side effects of medicines or diabetes, or for liver or kidney disease.

#### **Normal Results**

Normal values for the panel tests are:

- Albumin: 3.4 to 5.4 g/dL (34 to 54 g/L)
- Alkaline phosphatase: 20 to 130 U/L
- ALT (alanine aminotransferase): 4 to 36 U/L
- AST (aspartate aminotransferase): 8 to 33 U/L
- BUN (blood urea nitrogen): 6 to 20 mg/dL (2.14 to 7.14 mmol/L)
- Calcium: 8.5 to 10.2 mg/dL (2.13 to 2.55 mmol/L)
- Chloride: 96 to 106 mEq/L (96 to 106 mmol/L)
- CO<sub>2</sub> (carbon dioxide): 23 to 29 mEq/L (23 to 29 mmol/L)
- Creatinine: 0.6 to 1.3 mg/dL (53 to 114.9 μmol/L)
- Glucose: 70 to 100 mg/dL (3.9 to 5.6 mmol/L)
- Potassium: 3.7 to 5.2 mEq/L (3.70 to 5.20 mmol/L)
- Sodium: 135 to 145 mEq/L (135 to 145 mmol/L)
- Total bilirubin: 0.1 to 1.2 mg/dL (2 to 21 μmol/L)
- Total protein: 6.0 to 8.3 g/dL (60 to 83 g/L)

Normal values for creatinine can vary with age.

Normal value ranges for all tests may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal results can be due to a variety of different medical conditions. These may include kidney failure, liver disease, breathing problems, and diabetes or diabetes complications.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Cone biopsy**

### **Definition**

A cone biopsy (conization) is surgery to remove a sample of abnormal tissue from the cervix. The cervix is the lower part of the uterus (womb) that opens at the top of the vagina. Abnormal changes in the cells on the surface of the cervix is called cervical dysplasia.

### **Alternative Names**

Biopsy - cone; Cervical conization; CKC; Cervical intraepithelial neoplasia - cone biopsy; CIN - cone biopsy; Precancerous changes of the cervix - cone biopsy; Cervical cancer - cone biopsy; Squamous intraepithelial lesion - cone biopsy; LSIL - cone biopsy; HSIL - cone biopsy; Low-grade cone biopsy; High-grade cone biopsy; Carcinoma in situ-cone biopsy; CIS - cone biopsy; ASCUS - cone biopsy; Atypical glandular cells - cone biopsy; AGUS - cone biopsy; Atypical squamous cells - cone biopsy; Pap smear - cone biopsy; HPV - cone biopsy; Human papilloma virus - cone biopsy; Cervix - cone biopsy; Colposcopy - cone biopsy

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

This procedure is done in the hospital or in a surgery center. During the procedure:

- You will be given general anesthesia (asleep and pain-free), or medicines to help you relax and feel sleepy.
- You will lie on a table and place your feet in stirrups to position your pelvis for exam. The health care provider will place an instrument (speculum) into your vagina to better see the cervix.
- A small cone-shaped sample of tissue is removed from the cervix. The procedure may be performed using a wire loop heated by electrical current (LEEP procedure), a scalpel (cold knife biopsy), or a laser beam.
- The cervical canal above the cone biopsy may also be scraped to remove cells for evaluation. This is called an endocervical curettage (ECC).
- The sample is examined under a microscope for signs of cancer. This biopsy may also be a treatment if the provider removes all of the diseased tissue.

Most of the time, you will be able to go home the same day as the procedure.

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

You may be asked to not eat or drink for 6 to 8 hours before the test.

### **How the Test will Feel**

After the procedure, you may have some cramping or discomfort for about a week. For about 4 to 6 weeks avoid:

- Douching (douching should never be done)
- Sexual intercourse
- Using tampons

For 2 to 3 weeks after the procedure, you may have discharge that is:



- Bloody
- Heavy
- Yellow-colored

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

Cone biopsy is done to detect cervical cancer or early changes that lead to cancer. A cone biopsy is done if a test called colposcopy cannot find the cause of an abnormal Pap smear.

Cone biopsy may also be used to treat:

- Moderate to severe types of abnormal cell changes (called CIN II or CIN III)
- Very early stage cervical cancer (stage 0 or IA1)

### **Normal Results**

A normal result means there are no precancerous or cancerous cells in the cervix.

### **What Abnormal Results Mean**

Most often, abnormal results mean that there are precancerous or cancerous cells in the cervix.

These changes are called cervical intraepithelial neoplasia (CIN). The changes are divided into 3 groups:

- CIN I -- mild dysplasia
- CIN II -- moderate to marked dysplasia
- CIN III -- severe dysplasia to carcinoma in situ

Abnormal results may also be due to cervical cancer.

### **Risks**

Risks of cone biopsy include:

- Bleeding
- Incompetent cervix (which may lead to premature delivery)
- Infection
- Scarring of the cervix (which may cause painful periods, premature delivery, and difficulty getting pregnant)
- Damage to the bladder or rectum

Cone biopsy may also make it hard for your provider to interpret abnormal Pap smear results in the future.

### **Coombs test**

#### **Definition**

The Coombs test looks for antibodies that may stick to your red blood cells and cause red blood cells to die too early.

#### **Alternative Names**

Direct antiglobulin test; Indirect antiglobulin test; Anemia - hemolytic

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

A blood sample is needed.

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

No special preparation is necessary for this test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

There are two types of the Coombs test:

- Direct
- Indirect

The direct Coombs test is used to detect antibodies that are stuck to the surface of red blood cells. Many diseases and drugs can cause this to happen. These antibodies sometimes destroy red blood cells and cause anemia. Your health care provider may recommend this test if you have signs or symptoms of anemia or jaundice (yellowing of the skin or eyes).

The indirect Coombs test looks for antibodies that are floating in the blood. These antibodies could act against certain red blood cells. This test is most often done to determine if you may have a reaction to a blood transfusion.

### **Normal Results**

A normal result is called a negative result. It means there was no clumping of cells and you have no antibodies to red blood cells.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An abnormal (positive) direct Coombs test means you have antibodies that act against your red blood cells. This may be due to:

- Autoimmune hemolytic anemia
- Chronic lymphocytic leukemia or similar disorder
- Blood disease in newborns called erythroblastosis fetalis (also called hemolytic disease of the newborn)
- Infectious mononucleosis
- Mycoplasma infection
- Syphilis
- Systemic lupus erythematosus
- Transfusion reaction, such as one due to improperly matched units of blood

The test result may also be abnormal without any clear cause, especially among the older people.

An abnormal (positive) indirect Coombs test means you have antibodies that will act against red blood cells that your body views as foreign. This may suggest:

- Erythroblastosis fetalis
- Incompatible blood match (when used in blood banks)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Excessive bleeding
- Infection (a slight risk any time the skin is broken)

### **Cord blood testing**

#### **Definition**

Cord blood refers to a sample of blood collected from the umbilical cord when a baby is born. The umbilical cord is the cord connecting the baby to the mother's womb.

Cord blood testing can be done to evaluate a newborn's health.

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

Right after the birth of your baby, the umbilical cord is clamped and cut. If cord blood is to be drawn, another clamp is placed 8 to 10 inches (20 to 25 centimeters) away from the first. The section between the clamps is cut and a blood sample is collected into a specimen tube.

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

No special steps are needed to prepare for this test.

#### **How the Test will Feel**

You will not feel anything beyond the normal birthing process.

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

Cord blood testing is done to measure the following in your baby's blood:

- Bilirubin level
- Blood culture (if an infection is suspected)
- Blood gases (including oxygen, carbon dioxide, and pH levels)
- Blood sugar level
- Blood type and Rh
- Complete blood count (CBC)
- Platelet count

### **Normal Results**

Normal values mean that all items checked are within normal range.

### **What Abnormal Results Mean**

A low pH (less than 7.04 to 7.10) means there are higher levels of acids in the baby's blood. This might occur when the baby does not get enough oxygen during labor. One reason for this could be that the umbilical cord was compressed during labor or delivery.

A blood culture that is positive for bacteria means your baby has a blood infection.

High level of blood sugar (glucose) in the cord blood may be found if the mother has diabetes. The newborn will be watched for hypoglycemia (low blood sugar) after delivery.

High level of bilirubin in the newborn has many causes, which could be due to infections the baby gets.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your doctor about the meaning of your specific test results.

### **Considerations**

Most hospitals routinely collect cord blood for testing at birth. The process is fairly easy and this is the only time when this type of blood sample can be collected.

You can also decide to bank or donate cord blood at the time of your delivery. Cord blood can be used to treat certain types of bone marrow-related cancers. Some parents may choose to save (bank) their child's cord blood for this and other future medical purposes.

Cord blood banking for personal use is done by both cord blood banks and private companies.

There is a charge for the service if you use a private service. If you choose to bank your infant's cord blood, you should talk to your health care provider about the pros and cons of different options.

## **Coronary angiography**

### **Definition**

Coronary angiography is a procedure that uses a special dye (contrast material) and x-rays to see how blood flows through the arteries in your heart.

### **Alternative Names**

Cardiac angiography; Angiography - heart; Angiogram - coronary; Coronary artery disease - angiography; CAD - angiography; Angina - angiography; Heart disease - angiography

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

Coronary angiography is often done along with cardiac catheterization. This is a procedure which measures pressures in the heart chambers.

Before the test starts, you will be given a mild sedative to help you relax.

An area of your body (the arm or groin) is cleaned and numbed with a local numbing medicine (anesthetic). The cardiologist passes a thin hollow tube, called a catheter, through an artery and carefully moves it up into the heart. X-ray images help the doctor position the catheter.

Once the catheter is in place, dye (contrast material) is injected into the catheter. X-ray images are taken to see how the dye moves through the artery. The dye helps highlight any blockages in blood flow.

The procedure most often lasts 30 to 60 minutes.

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

You should not eat or drink anything for 8 hours before the test starts. You may need to stay in the hospital the night before the test. Otherwise, you will check in to the hospital the morning of the test.

You will wear a hospital gown. You must sign a consent form before the test. Your health care provider will explain the procedure and its risks.

Tell your provider if you:

- Are allergic to any medicines or if you have had a bad reaction to contrast material in the past
- Are taking Viagra
- Might be pregnant

### **How the Test will Feel**

In most cases, you will be awake during the test. You may feel some pressure at the site where the catheter is placed.

You may feel a flushing or warm sensation after the dye is injected.

After the test, the catheter is removed. You might feel a firm pressure being applied at the insertion site to prevent bleeding. If the catheter is placed in your groin, you will be asked to lie flat on your back for a few hours to several hours after the test to avoid bleeding. This may cause some mild back discomfort.

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

Coronary angiography may be done if:

- You have angina for the first time.
- Your angina that is becoming worse, not going away, occurring more often, or happening at rest (called unstable angina).
- You have aortic stenosis or another valve problem.
- You have atypical chest pain, when other tests are normal.
- You had an abnormal heart stress test.
- You are going to have surgery on your heart and you are at high risk for coronary artery disease.
- You have heart failure.
- You have been diagnosed as having a heart attack.

### **Normal Results**

There is a normal supply of blood to the heart and no blockages.

### **What Abnormal Results Mean**

An abnormal result may mean you have a blocked artery. The test can show how many coronary arteries are blocked, where they are blocked, and the severity of the blockages.

### **Risks**

Cardiac catheterization carries a slightly increased risk when compared with other heart tests. However, the test is very safe when performed by an experienced team.

Generally, the risk for serious complications ranges from 1 in 1,000 to 1 in 500. Risks of the procedure include the following:

- Cardiac tamponade
- Irregular heartbeats
- Injury to a heart artery
- Low blood pressure
- Allergic reaction to contrast dye or a medicine administered during the exam
- Stroke
- Heart attack

Considerations associated with any type of catheterization include the following:

- In general, there is a risk of bleeding, infection, and pain at the IV or catheter site.
- There is always a very small risk that the soft plastic catheters could damage the blood vessels or surrounding structures.
- Blood clots could form on the catheters and later block blood vessels elsewhere in the body.
- The contrast dye could damage the kidneys (particularly in people with diabetes or prior kidney problems).

### **Considerations**

If a blockage is found, your provider may perform a percutaneous coronary intervention (PCI) to open the blockage. This can be done during the same procedure, but may be delayed for various reasons.

## **Coronavirus**

### **Definition**

Coronaviruses are a family of viruses. Infection with these viruses can cause mild to moderate respiratory illnesses, such as the common cold. Some coronaviruses cause severe illness that can lead to pneumonia, and even death.

### **Alternative Names**

Coronavirus - SARS; Coronavirus - 2019-nCoV; Coronavirus - COVID-19; Coronavirus - Severe acute respiratory syndrome; Coronavirus - Middle East respiratory syndrome; Coronavirus - MERS

### **Causes**

There are many different coronaviruses. They affect both humans and animals. Common human coronaviruses cause mild to moderate illnesses, such as the common cold.

Some animal coronaviruses evolve (mutate) and are passed from animals to humans. They may then spread through person-to-person contact. The coronaviruses that spread from animals to humans can sometimes cause more severe illness:

- Severe acute respiratory syndrome (SARS) is a serious form of pneumonia. It is caused by the SARS-CoV coronavirus. No cases in humans have been reported since 2004.
- Middle East Respiratory Syndrome (MERS) is a severe respiratory illness. MERS is caused by the MERS-CoV coronavirus. About 30% of people who have gotten this illness have died. Some people only have mild symptoms. MERS continues to cause illness in humans, mainly in the Arabian Peninsula.
- COVID-19 -- Information about COVID-19 is available from the Centers for Disease Control and Prevention.

Many coronaviruses originate in bats, which can infect other animals. SARS-CoV spread from civet cats, while MERS-CoV spread from camels. The latest SARS-CoV-2 is also suspected to originate from animals. It is from the same family of viruses as SARS-CoV, which is why they have similar names. There are many other coronaviruses circulating in animals, but they haven't spread to humans.

Once a person has been infected by a coronavirus, the infection can spread to a healthy person (person-to-person transmission). You can catch coronavirus infection when:

- An infected person sneezes, coughs, or blows their nose near you and releases the virus into the air (droplet infection)
- You touch your nose, eyes, or mouth after you have touched something contaminated by the virus, such as a toy or doorknob
- You touch, hug, shake hands with, or kiss an infected person
- You eat or drink from the same utensils the infected person is using

### **Symptoms**

Human coronaviruses that cause the common cold spread from person-to-person. Symptoms develop in 2 to 14 days. These include:

- Runny nose
- Sore throat
- Sneezing
- Nasal congestion
- Fever with chills
- Headache
- Body aches
- Cough

Exposure to MERS-CoV, SARS-CoV, and SARS-CoV-2 can cause severe symptoms. These include:

- Nausea and vomiting
- Shortness of breath
- Diarrhea
- Blood in cough
- Death

Severe coronavirus infection may cause:

- Croup
- Pneumonia
- Bronchiolitis
- Bronchitis

Symptoms may be severe in certain people:

- Children
- Older adults
- People with chronic conditions such as diabetes, cancer, chronic kidney disease, heart diseases
- People with respiratory illnesses such as asthma or COPD

## **Exams and Tests**

Your health care provider may take a sample of the following for laboratory testing:

- Sputum culture
- Nasal swab (from the nostrils)
- Throat swab
- Blood tests

Stool and urine samples may also be taken in some cases.

You may need further testing if your infection is due to a severe form of coronavirus. These tests may include:

- Blood chemistry tests
- Chest x-ray or chest CT scan
- Complete blood count (CBC)
- Polymerase chain reaction (PCR) test for coronavirus

Diagnostic tests may not be available for all kinds of coronavirus.

## **Treatment**

To date there is no specific treatment for coronavirus infection. Medicines are given only to ease your symptoms. Experimental treatments are sometimes used in severe cases.

Mild coronavirus infections, such as the common cold, will go away in a few days with rest and self care at home.

If you are suspected to have a severe coronavirus infection, you may:

- Have to wear a surgical mask
- Stay in an isolated room or ICU for treatment

Treatment for severe infections may include:

- Antibiotics, if you also have bacterial pneumonia
- Antiviral medicines
- Steroids
- Oxygen, breathing support (mechanical ventilation), or chest therapy

## **Outlook (Prognosis)**

Common colds due to coronavirus usually resolve on their own. Severe coronavirus infections may require hospitalization and breathing support. Rarely, certain severe coronavirus infections may lead to death, especially in older people, children, or people with chronic conditions.

## **Possible Complications**

Coronavirus infections may lead to bronchitis or pneumonia. Some severe forms may cause organ failure, and even death.

## **When to Contact a Medical Professional**

Contact your provider if you have:

- Come in contact with a person with a severe coronavirus infection
- Travelled to a place which had an outbreak of a coronavirus infection and have developed common cold symptoms, shortness of breath, nausea, or diarrhea

## **Prevention**

There is no vaccine available to prevent a coronavirus infection. Follow these steps to lower your risk of infection:

- Avoid contact with people who have coronavirus infection.
- Avoid travelling to places that have an outbreak of coronavirus infection.
- Wash your hands properly or clean them with an alcohol-based hand sanitizer.
- Cover your mouth and nose with a tissue or sleeve (not your hands) when you sneeze or cough, and throw the tissue away.
- Do not share food, drink, or utensils.
- Clean commonly touched surfaces with a disinfectant.

If you are travelling, talk to your provider about:

- Being up-to-date with vaccines

## **Coronavirus disease 2019 (COVID-19)**

### **Definition**



Coronavirus disease 2019 (COVID-19) is a respiratory illness that causes fever, coughing, and shortness of breath. Some people with COVID-19 have died. Some people have none or only mild symptoms.

#### **Alternative Names**

Coronavirus - 2019; Coronavirus - novel 2019; 2019 Novel coronavirus; SARS-CoV-2

#### **Causes**

COVID-19 is caused by the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2). Coronaviruses are a family of viruses that can affect people and animals. They can cause mild to moderate respiratory illnesses, such as the common cold. Some coronaviruses can cause severe illness that can lead to pneumonia and even death.

COVID-19 was first reported in Wuhan City, Hubei Province, China in early December, 2019. Since then, it has spread throughout the world and within the United States.

SARS-CoV-2 is a betacoronavirus, like the MERS and SARS coronaviruses, which both originated in bats. It is thought that the virus spread from animals to humans. Now the virus is mainly spreading from person-to-person.

COVID-19 spreads to people within close contact (about 6 feet or 1.8 meters). When someone with the illness coughs or sneezes, droplets spray into the air. You can catch the illness if you breathe in these droplets. You may also get the illness if you touch a surface with the virus on it and then touch your eyes, nose, mouth or face. But this is not thought to be the main way the virus spreads.

COVID-19 can cause mild to serious illness and even death. It is also spreading from person to person quickly. The United States Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) consider COVID-19 a serious public health threat globally and in the United States. The situation is evolving quickly, so it's important to follow current local guidance on how to protect yourself and others from getting and spreading COVID-19.

#### **Symptoms**

COVID-19 symptoms have ranged from mild to severe, and some people have died from the illness. Older people and people with certain existing health conditions have a higher risk of developing severe illness:

- Heart disease
- Kidney disease
- COPD
- Obesity (BMI of 30 or above)
- Type 2 diabetes
- Organ transplantation
- Sickle cell disease

Symptoms of COVID-19 may include:

- Fever
- Chills; repeated shaking with chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle aches
- Headache
- Loss of sense of taste or smell
- Sore throat
- Stuffy or runny nose
- Nausea or vomiting
- Diarrhea

Some people may have no symptoms at all or may have some, but not all of the symptoms.

Symptoms may appear within 2 to 14 days after being exposed. Most often, symptoms appear around 5 days after exposure. However, you can spread the virus even when you do not have symptoms.

More severe symptoms that require seeking medical help right away include:

- Trouble breathing

- Chest pain or pressure that persists
- Confusion
- Inability to wake up
- Blue lips or face

### **Exams and Tests**

If you have symptoms of COVID-19, your provider may decide to test you for the disease. Not everyone needs to be tested.

If you do get tested for COVID-19, swabs from the back of the nose or throat will be collected. Samples of blood and sputum may also be taken. In some cases, samples of fluid from the lungs may be collected by bronchoscopy. Urine and stool samples also may be collected for further testing. If a person is thought to have COVID-19, these samples will be tested for SARS-CoV-2.

### **Treatment**

There is no specific treatment at this time. Supportive care is given to help relieve symptoms. People with severe illness will be treated in the hospital. Some people are being given experimental medicines.

Check with your health care provider before treating yourself or a loved one with vitamins, nutrients, or any medicines prescribed in the past for other health problems.

### **Possible Complications**

Complications can include:

- Respiratory failure
- Death

### **When to Contact a Medical Professional**

You should call your health care provider:

- If you have symptoms and think you may have been exposed to COVID-19
- If you have COVID-19 and your symptoms are getting worse

Call 911 or your local emergency number if you have:

- Trouble breathing
- Chest pain or pressure
- Confusion or inability to wake up
- Blue lips or face
- Any other symptoms that are severe or concern you

Before you go to a doctor's office or hospital emergency department (ED), call ahead and tell them that you have or think you may have COVID-19. Tell them about any underlying conditions you might have, such as heart disease, diabetes, or lung disease. If you have a face mask, wear it when you visit the office or ED, unless it makes it hard to breathe. This will help protect other people you come in contact with.

### **Prevention**

There is no vaccine for COVID-19. The best way to avoid infection is to avoid contact with people who have the virus.

If you have COVID-19 or have symptoms of it, you must isolate yourself at home and avoid contact with other people, both inside and outside your home, to avoid spreading the illness. This is called home isolation or self-quarantine.

- As much as possible, stay in a specific room and away from others in your home. Use a separate bathroom if you can. Do not leave your home except to get medical care.
- Do not travel while sick. Do not use public transportation or taxis.
- Keep track of your symptoms. You may receive instructions on how to check and report your symptoms.
- Stay in touch with your doctor. Before you go to a doctor's office or emergency department (ED), call ahead and tell them that you have or think you may have COVID-19.
- Use a face mask when you see your health care provider and anytime other people are in the same room with you. If you can't wear a mask, for example, due to breathing problems, people in your home should wear a mask if they need to be in the same room with you.
- Avoid contact with pets or other animals. (SARS-CoV-2 can spread from people to animals but it is not known how often this happens).

- Cover your mouth and nose with a tissue or your sleeve (not your hands) when coughing or sneezing. Droplets that are released when a person sneezes or coughs are infectious. Throw away the tissue after use.
- Wash your hands many times a day with soap and running water for at least 20 seconds. Do this before eating or preparing food, after using the toilet, and after coughing, sneezing, or blowing your nose. Use an alcohol-based hand sanitizer (at least 60% alcohol) if soap and water are not available.
- Avoid touching your face, eyes, nose, and mouth with unwashed hands.
- Do not share personal items such as cups, eating utensils, towels, or bedding. Wash anything you have used in soap and water.
- Clean all "high-touch" areas in the home, such as doorknobs, bathroom and kitchen fixtures, toilets, phones, tablets, and counters and other surfaces. Use a household cleaning spray and follow instructions for use.

You should remain at home, avoid contact with people, and follow the guidance of your provider and local health department about when to stop home isolation.

It's also important to help prevent the spread of the disease to protect people at high risk of serious illness and to protect health care providers who are at the front lines of dealing with COVID-19.

For that reason, everyone should practice social distancing. This means:

- Avoid crowded public places and mass gatherings, such as shopping centers, movie theaters, concert halls, conferences, and sports stadiums.
- Don't gather in groups larger than 10. The fewer people you spend time with, the better.
- Stay at least 6 feet (1.8 meters) from other people.
- Work from home (if that is an option).
- If you must go out, wear a face mask or cloth face cover in areas where it may be hard to maintain social distancing, such as a grocery store.

### **Cortical Auditory Evoked Potential Analyzer**

Determining how well a device like a hearing aid or cochlear implant is working for a baby or a cognitively delayed child, can be challenging. Hearlab's breakthrough technology gives at Children's Hospital's audiologists a way to better determine how well a hearing device is working by measuring a baby's response at the cortical level when a speech sound is presented.

With the advent of newborn hearing screening, we can now identify congenital hearing loss within weeks of a child's birth. But, determining how well a device like a hearing aid or cochlear implant is working for a baby or a cognitively delayed child, can be challenging. Children's Hospital Hearing Center is **the first center on the West Coast to use the HEARLab® System—Cortical Auditory Evoked Potential Analyzer (CAEP).**

The HEARLab System is new technology that can measure and show a patient's cortical response to sounds. This technology helps determine if the amplification of a hearing device or a cochlear implant is providing optimal benefit to an infant, toddler, or cognitively delayed older child.

"The HEARLab System provides us with another verification tool, to help infants, toddlers, or children hear better. HEARLab lets us measure the child's detection of speech sounds and perception of sound at varied intensities with and without a hearing device. We can actually **see a baby's response at the cortical level when a speech sound is presented.** This is helpful information when determining how well a device is working for each child."

**Infants cannot talk to you** as you adjust the amplification in a hearing test. **Their brains, however, produce cortical responses that give insight into their perception of speech sounds.** Using HEARLab technology, pediatric audiologists can determine if the amplification provided by a hearing device is strong enough to elicit an electrical response in the auditory cortex. This response data is used as an indication that child can perceive that sound. With this information, a pediatric audiologist is better able to customize and optimize a hearing device for the child. All this can be accomplished with no actual words or feedback from the patient.

"Each child is unique and this tool helps us fine tune a child's hearing device and cochlear implant, so we can give each child their best hearing experience. It is important to understand what a child's perception of normal speech sound is as early as possible because their speech understanding and language development depend on this."

The HearLab CAEP testing provides clear evidence of when more intervention is necessary such as hearing aid reprogramming or referral for cochlear implant. With HEARLab System we can:

- Conduct a series of tests using speech sounds
- See when the sound is detected by the auditory cortex
- Collect data on the evoked response with a hearing device and without aid
- Analyze the data
- **Offer a higher standard of care to pediatric patients who aren't able to give feedback**

If the newborn hearing screening indicates that your baby may have hearing loss, it's important to work with an audiologist at Children's Hearing & Speech Center and Children's Audiology Department to perform more comprehensive hearing tests. Devices such as a hearing aid or cochlear implant may be necessary to optimize your child's speech and language potential. We are excited to offer the first HEARLab System in California.

The information provided herein should not be used during any medical emergency or for the diagnosis or treatment of any medical condition. A licensed physician should be consulted for diagnosis and treatment of any and all medical conditions. Call 911 for all medical emergencies.

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### **Cortisol blood test**

#### **Definition**

The cortisol blood test measures the level of cortisol in the blood. Cortisol is a steroid (glucocorticoid or corticosteroid) hormone produced by the adrenal gland.

Cortisol can also be measured using a urine or saliva test.

#### **Alternative Names**

Serum cortisol

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

A blood sample is needed.

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

Your doctor will likely have you do the test early in the morning. This is important, because cortisol level varies throughout the day.

You may be asked not to do any vigorous exercising the day before the test.

You may also be told to temporarily stop taking medicines that can affect the test, including:

- Anti-seizure drugs
- Estrogen
- Human-made (synthetic) glucocorticoids, such as hydrocortisone, prednisone and prednisolone
- Androgens

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

The test is done to check for increased or decreased cortisol production. Cortisol is a glucocorticoid (steroid) hormone released from the adrenal gland in response to adrenocorticotropic hormone (ACTH). ACTH is a hormone released from the pituitary gland in the brain.

Cortisol affects many different body systems. It plays a role in:

- Bone growth
- Blood pressure control
- Immune system function
- Metabolism of fats, carbohydrates, and protein
- Nervous system function
- Stress response

Different diseases, such as Cushing syndrome and Addison disease, can lead to either too much or too little production of cortisol. Measuring blood cortisol level can help diagnose these conditions. It is also measured to evaluate how well the pituitary and adrenal glands are working. The test is often done before and 1 hour after injection of a medicine called ACTH (cosyntropin). This part of the test is called an ACTH stimulation test. It is an important test that helps check the function of the pituitary and adrenal glands.

Other conditions for which the test may be ordered include:

- Acute adrenal crisis, a life-threatening condition that occurs when there is not enough cortisol
- Sepsis, an illness in which the body has a severe response to bacteria or other germs
- Low blood pressure

### **Normal Results**

Normal values for a blood sample taken at 8 in the morning are 5 to 25 mcg/dL or 140 to 690 nmol/L.

Normal values depend on the time of day and the clinical context. Normal ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level may indicate:

- Cushing disease, in which the pituitary gland makes too much ACTH because of excess growth of the pituitary gland or a tumor in the pituitary gland
- Ectopic Cushing syndrome, in which a tumor outside the pituitary or adrenal glands makes too much ACTH
- Tumor of the adrenal gland that is producing too much cortisol
- Stress
- Acute illness

A lower than normal level may indicate:

- Addison disease, in which the adrenal glands do not produce enough cortisol
- Hypopituitarism, in which the pituitary gland does not signal the adrenal gland to produce enough cortisol
- Suppression of normal pituitary or adrenal function by glucocorticoid medicines including pills, skin creams, eyedrops, inhalers, joint injections, chemotherapy

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Cortisol urine test**

#### **Definition**

The cortisol urine test measures the level of cortisol in the urine. Cortisol is a glucocorticoid (steroid) hormone produced by the adrenal gland.

Cortisol can also be measured using a blood or saliva test.

#### **Alternative Names**

24-hour urinary free cortisol (UFC)

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

A 24-hour urine sample is needed. You will need to collect your urine over 24 hours in a container provided by the laboratory. Your health care provider will tell you how to do this. Follow instructions exactly.

Because cortisol production by the adrenal gland can vary, the test may need to be done three or more separate times to get a more accurate picture of average cortisol production.

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

You may be asked not to do any vigorous exercising the day before the test.

You may also be told to temporarily stop taking medicines that can affect the test, including:

- Anti-seizure drugs
- Estrogen
- Human-made (synthetic) glucocorticoids, such as hydrocortisone, prednisone and prednisolone
- Androgens

### **How the Test will Feel**

The test involves only normal urination. There is no discomfort.

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

The test is done to check for increased or decreased cortisol production. Cortisol is a glucocorticoid (steroid) hormone released from the adrenal gland in response to adrenocorticotrophic hormone (ACTH). This is a hormone released from the pituitary gland in the brain. Cortisol affects many different body systems. It plays a role in:

- Bone growth
- Blood pressure control
- Immune system function
- Metabolism of fats, carbohydrates, and protein
- Nervous system function
- Stress response

Different diseases, such as Cushing syndrome and Addison disease, can lead to either too much or too little production of cortisol. Measuring urine cortisol level can help diagnose these conditions.

### **Normal Results**

Normal range is 4 to 40 mcg/24 hours or 11 to 110 nmol/day.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level may indicate:

- Cushing disease, in which the pituitary gland makes too much ACTH because of excess growth of the pituitary gland or a tumor in the pituitary gland
- Ectopic Cushing syndrome, in which a tumor outside the pituitary or adrenal glands makes too much ACTH
- Severe depression
- Tumor of the adrenal gland that is producing too much cortisol
- Severe stress
- Rare genetic disorders

A lower than normal level may indicate:

- Addison disease in which the adrenal glands do not produce enough cortisol
- Hypopituitarism in which the pituitary gland does not signal the adrenal gland to produce enough cortisol
- Suppression of normal pituitary or adrenal function by glucocorticoid medicines including pills, skin creams, eyedrops, inhalers, joint injections, chemotherapy

### **Risks**

There are no risks with this test.

### **COVID-19 antibody test**

#### **Definition**

This blood test shows if you have antibodies against the virus that causes COVID-19. Antibodies are proteins produced by the body in response to harmful substances, such as viruses and bacteria. Antibodies may help protect you from getting infected again (immune).

The COVID-19 antibody test is not used to diagnose a current infection with COVID-19. To test if you are currently infected, you will need a SARS CoV-2 (or COVID-19) virus test.

#### **Alternative Names**

SARS CoV-2 antibody test; COVID-19 serologic test; COVID 19 - past infection



**How the Test is Performed**

A blood sample is needed.

The blood sample will be sent to a laboratory for testing. The test can detect one or more types of antibodies to SARS-CoV-2, the virus that causes COVID-19.

**How to Prepare for the Test**

No special preparation is needed.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

The COVID-19 antibody test can show if you were infected with the virus that causes COVID-19.

**Normal Results**

The test is considered normal when it is negative. If you test negative, you likely have not had COVID-19 in the past.

However, there are other reasons that may explain a negative test result.

- It typically takes 1 to 3 weeks after infection for antibodies to show up in your blood. If you are tested before antibodies are present, the result will be negative.
- This means that you could have recently been infected with COVID-19 and still test negative.
- Talk with your healthcare provider about whether you should have this test repeated.

Even if you tested negative, there are steps you should take to avoid getting infected or spreading the virus. These include practicing social distancing and wearing a face mask.

**What Abnormal Results Mean**

The test is considered abnormal when it is positive. This means you have antibodies to the virus that causes COVID-19. A positive test suggests:

- You may have been infected with SARS-CoV-2, the virus that causes COVID-19.
- You may have been infected with another virus from the same family of viruses (coronavirus).

You may or may not have had symptoms at the time of the infection.

A positive result does not mean that you are immune to COVID-19. It is not certain if having these antibodies means that you are protected from future infections, or for how long the protection might last. Talk with your provider about what your test results mean. Your provider may recommend a second antibody test for confirmation.

If you tested positive and you have symptoms of COVID-19, you may need a diagnostic test to confirm an active infection with SARS-CoV-2. Contact your provider to find out what to do next. You should also isolate yourself in your home and take steps to protect others from getting COVID-19.

**COVID-19 symptoms****Definition**

COVID-19 is a highly infectious respiratory illness caused by a new, or novel, virus. COVID-19 is spreading quickly throughout the world and within the United States.

COVID-19 symptoms can range from mild to severe, and some people have died from the illness.

Symptoms may include:

- Fever
- Chills; repeated shaking with chills
- Cough
- Shortness of breath or difficulty breathing
- Fatigue
- Muscle aches
- Headache
- Loss of sense of taste or smell
- Sore throat
- Stuffy or runny nose
- Nausea and vomiting
- Diarrhea

Some people may have no symptoms at all or have some, but not all of the symptoms. Symptoms may develop within 2 to 14 days after you are exposed to the virus. Most often, symptoms appear around 5 days after exposure. However, you can spread the virus even when you do not have symptoms.

More severe symptoms that require seeking medical help right away include:

- Trouble breathing
- Chest pain or pressure that persists
- Confusion
- Inability to wake up
- Blue lips or face

Older people and people with certain existing health conditions have a higher risk of developing severe illness:

- Heart disease
- Kidney disease
- COPD
- Obesity (BMI of 30 or above)
- Type 2 diabetes
- Organ transplantation
- Sickle cell disease

### **Alternative Names**

Coronavirus novel 2019 - symptoms; 2019 Novel coronavirus - symptoms; SARS-Co-V2 - symptoms

### **Considerations**

Some symptoms of COVID-19 are similar to those of the common cold and the flu, so it can be hard to know for sure if you have the virus. But COVID-19 is not a cold, and it is not a flu.

The only way to know if you have COVID-19 is to be tested. If you want to be tested, you should contact your health care provider. You can also visit your state or local health department's website. This will give you the latest local guidance on testing.

Most people with the illness have mild to moderate symptoms and recover fully. Whether you get tested or not, if you have symptoms of COVID-19, you should avoid contact with other people so you don't spread the illness.

The United States Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) consider COVID-19 a serious public health threat. For the most up-to-date news and information about COVID-19, you can visit the following websites:

Centers for Disease Control and Prevention website. Coronavirus (COVID-19) -- [www.cdc.gov/coronavirus/2019-ncov/index.html](http://www.cdc.gov/coronavirus/2019-ncov/index.html).

World Health Organization website. Coronavirus Disease 2019 (COVID-19) pandemic -- [www.who.int/emergencies/diseases/novel-coronavirus-2019](http://www.who.int/emergencies/diseases/novel-coronavirus-2019).

### **Causes**

COVID-19 is caused by the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2). Coronaviruses are a family of viruses that can affect people and animals. They can cause mild to severe respiratory illnesses.

COVID-19 spreads to people within close contact (about 6 feet or 1.8 meters). When someone with the illness coughs or sneezes, infectious droplets spray into the air. You can catch the illness if you breathe in or touch these particles.

### **Home Care**

If you have COVID-19 or think you have it, you must isolate yourself at home and avoid contact with other people, both inside and outside your home, to avoid spreading the illness. This is called home isolation or self quarantine.

- As much as possible, stay in one room and away from others in your home. Use a separate bathroom if you can. Do not leave your home except to get medical care if needed.
- Keep track of your symptoms. You may receive instructions on how to check and report your symptoms.

- Use a face mask when you are with people in the same room and when you see your provider. If you can't wear a mask, people in your home should wear a mask if they need to be in the same room with you.
- Avoid contact with pets or other animals. (SARS-CoV-2 can spread from people to animals, but it is not known how often this happens). Cover your mouth and nose with a tissue or your sleeve (not your hands) when coughing or sneezing. Throw away the tissue after use.
- Wash your hands often with soap and water for at least 20 seconds. Do this before eating or preparing food, after using the toilet, and after coughing, sneezing, or blowing your nose. Use an alcohol-based hand sanitizer (at least 60% alcohol) if soap and water are not available.
- Avoid touching your face, eyes, nose, and mouth with unwashed hands.
- Do not share personal items such as cups, eating utensils, towels, or bedding. Wash anything you have used in soap and water. Use an alcohol-based hand sanitizer (at least 60% alcohol) if soap and water are not available.
- Clean all "high-touch" areas in the home, such as doorknobs, bathroom and kitchen fixtures, toilets, phones, tablets, and counters and other surfaces. Use a household cleaning spray and follow instructions for use.
- You should remain at home and avoid contact with people until your provider tells you it is safe to end home isolation.

To help treat the symptoms of COVID-19, the following tips may help.

- Rest and drink plenty of fluids.
- Acetaminophen (Tylenol) and ibuprofen (Advil, Motrin) help reduce fever. Sometimes, providers advise you to use both types of medicine. Take the recommended amount to reduce fever. DO NOT use ibuprofen in children 6 months or younger.
- Aspirin works well to treat fever in adults. DO NOT give aspirin to a child (under age 18 years) unless your child's provider tells you to.
- A lukewarm bath or sponge bath may help cool a fever. Keep taking medicine -- otherwise your temperature might go back up.
- If you have a dry, tickling cough, try cough drops or hard candy.
- Use a vaporizer or take a steamy shower to increase moisture in the air and help soothe a dry throat and cough.
- Do not smoke, and stay away from secondhand smoke.

### **When to Contact a Medical Professional**

You should contact your provider right away:

- If you have symptoms and think you may have been exposed to COVID-19
- If you have COVID-19 and your symptoms are getting worse

Call 911 or the local emergency number if you have:

- Trouble breathing
- Chest pain or pressure
- Confusion or inability to wake up
- Blue lips or face
- Any other symptoms that are severe or that concern you

Before you go to a doctor's office or hospital emergency department (ED), call ahead and tell them that you have or think you may have COVID-19. Tell them about any underlying conditions you might have, such as heart disease, diabetes, or lung disease. Wear a cloth face mask when you visit the office or ED, unless it makes it hard to breathe. This will help protect other people you come in contact with.

### **What to Expect at Your Office Visit**

Your provider will ask about your symptoms, any recent travel, and any possible exposure to COVID-19. Your provider may take swab samples from the back of your nose and throat. If needed, your provider may also take other samples, such as blood or sputum.

If your symptoms do not indicate a medical emergency, your provider may decide to monitor your symptoms while you recover at home. You will have to remain away from others within your

home and not leave the house until your provider says you can stop home isolation. For more serious symptoms, you may need to go to the hospital for care.

### **COVID-19 virus test**

#### **Definition**

To test for the virus that causes COVID-19, a health care provider will take a mucus sample from your upper respiratory tract. This test is used to diagnose COVID-19.

The COVID-19 virus test is not used to test your immunity to COVID-19. To test if you have antibodies against the SARS CoV-2 virus, you need a COVID-19 antibody test.

#### **Alternative Names**

COVID 19 - Nasopharyngeal swab; SARS CoV-2 test

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

You will be asked to cough before the test begins and then tilt your head back slightly. A sterile, cotton-tipped swab is gently passed through a nostril and into the nasopharynx. This is the uppermost part of the throat, behind the nose. The swab is left in place for several seconds, rotated, and removed.

There are two types of virus tests available that can diagnose COVID-19:

- Polymerase chain reaction (PCR) tests detect the genetic material of the virus that causes COVID-19. The samples are usually sent to a laboratory for testing, and results are available in a few days. There are also rapid PCR diagnostic tests that are run on specialized equipment on-site, for which the results are available immediately.
- Antigen tests detect specific proteins on the virus that causes COVID-19. Antigen tests are rapid diagnostic tests, which means the samples are tested on-site, and results are available in several minutes.
- Rapid diagnostic tests of any kind are less accurate than the regular PCR test. If you get a negative result on a rapid test, but have symptoms of COVID-19, your provider may do a non-rapid PCR test.

If you have a cough that produces phlegm, the provider may also collect a sputum sample.

Sometimes, secretions from your lower respiratory tract can also be used to test for the virus that causes COVID-19.

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

No special preparation is needed.

#### **How the Test will Feel**

You may have slight or moderate discomfort and may gag.

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

The test identifies the SARS-CoV-2 virus (severe acute respiratory syndrome coronavirus 2), which causes COVID-19.

#### **Normal Results**

The test is considered normal when it is negative. A negative test means that at the time you were tested, you probably didn't have the virus that causes COVID-19 in your respiratory tract. But you can test negative if you were tested too early after infection for COVID-19 to be detected. And you can have a positive test later if you are exposed to the virus after you were tested.

For this reason, if you have symptoms of COVID-19 or you are at risk for contracting COVID-19, your provider may recommend being retested at a later time.

#### **What Abnormal Results Mean**

A positive test means that you are infected with SARS-CoV-2. You may or may not have symptoms of COVID-19, the illness caused by the virus. Whether you have symptoms or not, you can still spread the illness to others. You should isolate yourself in your home and learn how to protect others from developing COVID-19. You should stay at home and away from others until you meet the guidelines for ending home isolation

### **CPK isoenzymes test**

#### **Definition**

The creatine phosphokinase (CPK) isoenzymes test measures the different forms of CPK in the blood. CPK is an enzyme found mainly in the heart, brain, and skeletal muscle.

#### **Alternative Names**

Creatine phosphokinase - isoenzymes; Creatine kinase - isoenzymes; CK - isoenzymes; Heart attack - CPK; Crush - CPK

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

A blood sample is needed. This may be taken from a vein. The test is called a venipuncture.

If you are in the hospital, this test may be repeated over 2 or 3 days. A significant rise or fall in the total CPK or CPK isoenzymes can help your health care provider diagnose certain conditions.

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

No special preparation is needed in most cases.

Tell your provider about all the medicines you are taking. Some drugs can interfere with test results. Drugs that can increase CPK measurements include the following:

- Alcohol
- Amphotericin B
- Certain anesthetics
- Cocaine
- Fibrate drugs
- Statins
- Steroids, such as dexamethasone

This list is not all-inclusive.

### **How the Test will Feel**

You may feel slight pain when the needle is inserted to draw blood. Some people feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

This test is done if a CPK test shows that your total CPK level is elevated. CPK isoenzyme testing can help find the exact source of the damaged tissue.

CPK is made of three slightly different substances:

- CPK-1 (also called CPK-BB) is found mostly in the brain and lungs
- CPK-2 (also called CPK-MB) is found mostly in the heart
- CPK-3 (also called CPK-MM) is found mostly in skeletal muscle

### **What Abnormal Results Mean**

Higher-than-normal CPK-1 levels:

Because CPK-1 is found mostly in the brain and lungs, injury to either of these areas can increase CPK-1 levels. Increased CPK-1 levels may be due to:

- Brain cancer
- Brain injury (due to any type of injury including, stroke, or bleeding in the brain)
- Electroconvulsive therapy
- Pulmonary infarction
- Seizure

Higher-than-normal CPK-2 levels:

CPK-2 levels rise 3 to 6 hours after a heart attack. If there is no further heart muscle damage, the level peaks at 12 to 24 hours and returns to normal 12 to 48 hours after tissue death.

Increased CPK-2 levels may also be due to:

- Electrical injuries
- Heart defibrillation (purposeful shocking of the heart by medical personnel)
- Heart injury (for instance, from a car accident)
- Inflammation of the heart muscle usually due to a virus (myocarditis)
- Open heart surgery

Higher-than-normal CPK-3 levels are most often a sign of muscle injury or muscle stress. They may be due to:

- Crush injuries
- Muscle damage due to drugs or being immobile for a long time (rhabdomyolysis)
- Muscular dystrophy
- Myositis (skeletal muscle inflammation)
- Receiving many intramuscular injections
- Recent nerve and muscle function testing (electromyography)
- Recent seizures

- Recent surgery
- Strenuous exercise

### **Considerations**

Factors that can affect test results include cardiac catheterization, intramuscular injections, recent surgery, and vigorous and prolonged exercise or immobilization.

Isoenzyme testing for specific conditions is about 90% accurate.

### **C-reactive protein**

#### **Definition**

C-reactive protein (CRP) is produced by the liver. The level of CRP rises when there is inflammation throughout the body. It is one of a group of proteins called acute phase reactants that go up in response to inflammation. The levels of acute phase reactants increase in response to certain inflammatory proteins called cytokines. These proteins are produced by white blood cells during inflammation.

This article discusses the blood test done to measure the amount of CRP in your blood.

#### **Alternative Names**

CRP; High-sensitivity C-reactive protein; hs-CRP

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

A blood sample is needed. This is most often taken from a vein. The procedure is called a venipuncture.

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

No special steps are needed to prepare for this test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others may feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

The CRP test is a general test to check for inflammation in the body. It is not a specific test. That means it can reveal that you have inflammation somewhere in your body, but it cannot pinpoint the exact location. The CRP test is often done with the ESR or sedimentation rate test which also looks for inflammation.

You may have this test to:

- Check for flare-ups of inflammatory diseases such as rheumatoid arthritis, lupus, or vasculitis.
- Determine if anti-inflammatory medicine is working to treat a disease or condition.

However, a low CRP level does not always mean that there is no inflammation present. Levels of CRP may not be increased in people with rheumatoid arthritis and lupus. The reason for this is unknown.

A more sensitive CRP test, called a high-sensitivity C-reactive protein (hs-CRP) assay, is available to determine a person's risk for heart disease.

#### **Normal Results**

Normal CRP values vary from lab to lab. Generally, there are low levels of CRP detectable in the blood. The levels often increase slightly with age, female gender and in African Americans.

Increased serum CRP is related to traditional cardiovascular risk factors and may reflect the role of these risk factors in causing vascular inflammation.

According to the American Heart Association, results of the hs-CRP in determining the risk for heart disease can be interpreted as follows:

- You are at low risk of developing cardiovascular disease if your hs-CRP level is lower than 1.0 mg/L.
- You are at average risk of developing cardiovascular disease if your levels are between 1.0 mg/L and 3.0 mg/L.
- You are at high risk for cardiovascular disease if your hs-CRP level is higher than 3.0 mg/L.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.



### **What Abnormal Results Mean**

A positive test means you have inflammation in the body. This may be due to a variety of conditions, including:

- Cancer
- Connective tissue disease
- Heart attack
- Infection
- Inflammatory bowel disease (IBD)
- Lupus
- Pneumonia
- Rheumatoid arthritis
- Rheumatic fever
- Tuberculosis

This list is not all inclusive.

Note: Positive CRP results also occur during the last half of pregnancy or with the use of birth control pills (oral contraceptives).

### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Creatine phosphokinase test**

#### **Definition**

Creatine phosphokinase (CPK) is an enzyme in the body. It is found mainly in the heart, brain, and skeletal muscle. This article discusses the test to measure the amount of CPK in the blood.

#### **Alternative Names**

CPK test

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

A blood sample is needed. This may be taken from a vein. The procedure is called a venipuncture. This test may be repeated over 2 or 3 days if you are a patient in the hospital.

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

No special preparation is needed most of the time.

Tell your health care provider about any medicines you are taking. Drugs that can increase CPK measurements include amphotericin B, certain anesthetics, statins, fibrates, dexamethasone, alcohol, and cocaine.

#### **How the Test will Feel**

You may feel slight pain when the needle is inserted to draw blood. Some people feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

When the total CPK level is very high, it most often means there has been injury or stress to muscle tissue, the heart, or the brain.

Muscle tissue injury is most likely. When a muscle is damaged, CPK leaks into the bloodstream. Finding which specific form of CPK is high helps determine which tissue has been damaged.

This test may be used to:

- Diagnose heart attack
- Evaluate cause of chest pain
- Determine if or how badly a muscle is damaged
- Detect dermatomyositis, polymyositis, and other muscle diseases
- Tell the difference between malignant hyperthermia and postoperative infection

The pattern and timing of a rise or fall in CPK levels can be significant in making a diagnosis. This is particularly true if a heart attack is suspected.

In most cases other tests are used instead of or with this test to diagnose a heart attack.

#### **Normal Results**

Total CPK normal values:

- 10 to 120 micrograms per liter (mcg/L)

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

High CPK levels may be seen in people who have:

- Brain injury or stroke
- Convulsions
- Delirium tremens
- Dermatomyositis or polymyositis
- Electric shock
- Heart attack
- Inflammation of the heart muscle (myocarditis)
- Lung tissue death (pulmonary infarction)
- Muscular dystrophies
- Myopathy
- Rhabdomyolysis

Other conditions that may give positive test results include:

- Hypothyroidism
- Hyperthyroidism
- Pericarditis following a heart attack

### **Risks**

Risks associated with having blood drawn are slight but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**

Other tests should be done to find the exact location of muscle damage.

Factors that may affect test results include cardiac catheterization, intramuscular injections, trauma to muscles, recent surgery, and heavy exercise.

### **Creatinine blood test**

#### **Definition**

The creatinine blood test measures the level of creatinine in the blood. This test is done to see how well your kidneys are working.

Creatinine can also be measured with a urine test.

#### **Alternative Names**

Serum creatinine; Kidney function - creatinine; Renal function - creatinine

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

A blood sample is needed.

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

The health care provider may tell you to temporarily stop taking certain medicines that can affect the test. These medicines include:

- Cimetidine, famotidine, and ranitidine
- Certain antibiotics, such as trimethoprim

Tell your provider about all the medicines you take.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Creatinine is a chemical waste product of creatine. Creatine is a chemical made by the body and is used to supply energy mainly to muscles.

This test is done to see how well your kidneys work. Creatinine is removed from the body entirely by the kidneys. If kidney function is not normal, the creatinine level in your blood will increase. This is because less creatinine is excreted through your urine.

### **Normal Results**

A normal result is 0.7 to 1.3 mg/dL (61.9 to 114.9  $\mu$ mol/L) for men and 0.6 to 1.1 mg/dL (53 to 97.2  $\mu$ mol/L) for women.

Women often have a lower creatinine level than men. This is because women often have less muscle mass than men. Creatinine level varies based on a person's size and muscle mass.

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

A higher than normal level may be due to:

- Blocked urinary tract
- Kidney problems, such as kidney damage or failure, infection, or reduced blood flow
- Loss of body fluid (dehydration)
- Muscle problems, such as breakdown of muscle fibers (rhabdomyolysis)
- Problems during pregnancy, such as seizures caused by eclampsia or high blood pressure caused by preeclampsia

A lower than normal level may be due to:

- Conditions involving the muscles and nerves that lead to decreased muscle mass
- Malnutrition

There are many other conditions for which the test may be ordered, such as high blood pressure, diabetes, or medicine overdose. Your provider will tell you more, if needed.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Creatinine clearance test**

#### **Definition**

The creatinine clearance test helps provide information about how well the kidneys are working. The test compares the creatinine level in urine with the creatinine level in blood.

#### **Alternative Names**

Serum creatinine clearance; Kidney function - creatinine clearance; Renal function - creatinine clearance

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

This test requires both a urine sample and blood sample. You will collect your urine for 24 hours and then have blood taken. Follow instructions exactly. This ensures accurate results.

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

Your health care provider may ask you to temporarily stop any medicines that may affect the test results. These include some antibiotics and stomach acid medicines. Be sure to tell your provider about all the medicines you take.

DO NOT stop taking any medicine before talking to your provider.

#### **How the Test will Feel**

The urine test involves only normal urination. There is no discomfort.

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Creatinine is a chemical waste product of creatine. Creatine is a chemical the body makes to supply energy, mainly to muscles.

By comparing the creatinine level in urine with the creatinine level in blood, the creatinine clearance test estimates the glomerular filtration rate (GFR). GFR is a measure of how well the kidneys are working, especially the kidneys' filtering units. These filtering units are called glomeruli.

Creatinine is removed, or cleared, from the body entirely by the kidneys. If kidney function is abnormal, creatinine level increases in the blood because less creatinine is excreted through the urine.

### **Normal Results**

Clearance is often measured as milliliters per minute (mL/min) or milliliters per second (mL/s). Normal values are:

- Male: 97 to 137 mL/min (1.65 to 2.33 mL/s).
- Female: 88 to 128 mL/min (1.46 to 2.18 mL/s).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor to know about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal results (lower than normal creatinine clearance) may indicate:

- Kidney problems, such as damage to the tubule cells
- Kidney failure
- Too little blood flow to the kidneys
- Damage to the filtering units of the kidneys
- Loss of body fluids (dehydration)
- Bladder outlet obstruction
- Heart failure

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Creatinine urine test**

#### **Definition**

The creatinine urine test measures the amount of creatinine in urine. This test is done to see how well your kidneys are working.

Creatinine can also be measured by a blood test.

#### **Alternative Names**

Urine creatinine test

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

After you provide a urine sample, it is tested in the lab. If needed, your doctor may ask you to collect your urine at home over 24 hours. Your health care provider will tell you how to do this. Follow instructions exactly so that the results are accurate.

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

Your provider may tell you to temporarily stop taking certain medicines that may affect test results. Be sure to tell your provider about all the medicines you take. These include:

- Antibiotics such as cefoxitin or trimethoprim
- Cimetidine

DO NOT stop taking any medicine before talking to your provider.

#### **How the Test will Feel**

The test involves only normal urination. There is no discomfort.

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

Creatinine is a chemical waste product of creatine. Creatine is a chemical the body makes to supply energy, mainly to muscles.

This test is done to see how well your kidneys work. Creatinine is removed by the body entirely by the kidneys. If kidney function is not normal, creatinine level in your urine decreases.

This test can be used for the following:

- To evaluate how well the kidneys are working
- As part of the creatinine clearance test
- To provide information on other chemicals in the urine, such as albumin or protein

### **Normal Results**

Urine creatinine (24-hour urine collection) values can range from 500 to 2000 mg/day (4,420 to 17,680 mmol/day). Results depend on your age and amount of lean body mass.

Another way of expressing the normal range for test results is:

- 14 to 26 mg per kg of body mass per day for men (123.8 to 229.8  $\mu\text{mol/kg/day}$ )
- 11 to 20 mg per kg of body mass per day for women (97.2 to 176.8  $\mu\text{mol/kg/day}$ )

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal results of urine creatinine may be due to any of the following:

- High meat diet
- Kidney problems, such as damage to the tubule cells
- Kidney failure
- Too little blood flow to the kidneys, causing damage to filtering units
- Kidney infection (pyelonephritis)
- Muscle breakdown (rhabdomyolysis), or loss of muscle tissue (myasthenia gravis)
- Urinary tract obstruction

### **Risks**

There are no risks with this test.

### **Cryoglobulins**

#### **Definition**

Cryoglobulins are antibodies that become solid or gel-like at low temperatures in the laboratory. This article describes the blood test used to check for them.

In the laboratory, cryoglobulins come out of solution in blood when the blood sample is cooled below 98.6°F (37°C). They dissolve again when the sample is warmed up.

Cryoglobulins come in three main types, but in 90% of cases, the cause is hepatitis C. The disease in which cryoglobulins are found is called cryoglobulinemia. Cryoglobulins can cause inflammation in blood vessels, called vasculitis. They may also cause inflammation in the kidney, nerves, joints, lungs and skin.

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

Because they are temperature sensitive, cryoglobulins are hard to accurately measure. The blood specimen must be collected in a special way. Test should only be done in laboratories that are equipped for it.

Blood is drawn from a vein. A vein on the inside of the elbow or the back of the hand is used in most cases. Blood should NOT be drawn from a catheter that has heparin in it. The site is cleaned with germ-killing medicine (antiseptic). The health care provider wraps an elastic band around the upper arm to apply pressure to the area and make the vein swell with blood.

Next, the provider gently inserts a needle into the vein. The blood collects into an airtight vial or tube attached to the needle. The elastic band is removed from your arm. The vial should be warm at room or body temperature, before it is used. Vials that are colder than room temperature may not give accurate results.

Once the blood has been collected, the needle is removed, and the puncture site is covered to stop any bleeding.

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

You may want to call ahead to ask to have your blood drawn by a lab technician who has experience collecting blood for this test.

**How the Test will Feel**

Some people feel discomfort when the needle is inserted. Afterward, there may be some throbbing.

**Why the Test is Performed**

This test is most often done when a person has symptoms of a condition associated with cryoglobulins. Cryoglobulins are associated with cryoglobulinemia. They also occur in other conditions that affect the skin, joints, kidneys, and nervous system.

**Normal Results**

Normally, there are no cryoglobulins.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurement for results for these tests. Some laboratories use different measurements or may test different specimens.

**What Abnormal Results Mean**

A positive test may indicate:

- Hepatitis (especially hepatitis C)
- Infectious mononucleosis
- Leukemia
- Lymphoma
- Macroglobulinemia -- primary
- Multiple myeloma
- Rheumatoid arthritis
- Systemic lupus erythematosus

Additional conditions under which the test may be performed includes nephrotic syndrome.

**Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

**CSF analysis****Definition**

Cerebrospinal fluid (CSF) analysis is a group of laboratory tests that measure chemicals in the cerebrospinal fluid. CSF is a clear fluid that surrounds and protects the brain and spinal cord. The tests may look for proteins, sugar (glucose), and other substances.

**Alternative Names**

Cerebrospinal fluid analysis

**How the Test is Performed**

A sample of CSF is needed. A lumbar puncture, also called a spinal tap, is the most common way to collect this sample. Less common ways to take a fluid sample include:

- Cisternal puncture
- Removal of CSF from a tube that is already in the CSF, such as a shunt, ventricular drain, or pain pump
- Ventricular puncture

After the sample is taken, it is sent to the laboratory for evaluation.

Your doctor will ask you to lie flat for at least one hour after the lumbar puncture. You may develop a headache after the lumbar puncture. If it happens, drinking caffeinated beverages such as coffee, tea or soda may help.

**How to Prepare for the Test**

Your health care provider will tell you how to prepare for lumbar puncture.

**Why the Test is Performed**

Analysis of CSF can help detect certain conditions and diseases. All of the following can be, but are not always, measured in a sample of CSF:

- Antibodies and DNA of common viruses



- Bacteria (including that which causes syphilis, using a VDRL test)
- Cell count
- Chloride
- Cryptococcal antigen
- Glucose
- Glutamine
- Lactate dehydrogenase
- Oligoclonal banding to look for specific proteins
- Myelin basic protein
- Total protein
- Whether there are cancerous cells present
- Opening pressure

### **Normal Results**

Normal results include:

- Antibodies and DNA of common viruses: None
- Bacteria: No bacteria grows in a lab culture
- Cancerous cells: No cancerous cells present
- Cell count: less than 5 white blood cells (all mononuclear) and 0 red blood cells
- Chloride: 110 to 125 mEq/L (110 to 125 mmol/L)
- Fungus: None
- Glucose: 50 to 80 mg/dL or 2.77 to 4.44 mmol/L (or greater than two-thirds of blood sugar level)
- Glutamine: 6 to 15 mg/dL (410.5 to 1,026 micromol/L)
- Lactate dehydrogenase: less than 40 U/L
- Oligoclonal bands: 0 or 1 bands that are not present in a matched serum sample
- Protein: 15 to 60 mg/dL (0.15 to 0.6 g/L)
- Opening pressure: 90 to 180 mm of water
- Myelin basic protein: Less than 4 ng/mL

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

An abnormal CSF analysis result may be due to many different causes, including:

- Cancer
- Encephalitis (such as West Nile and Eastern Equine)
- Hepatic encephalopathy
- Infection
- Inflammation
- Reye syndrome
- Meningitis due to bacteria, fungus, tuberculosis, or a virus
- Multiple sclerosis (MS)
- Alzheimer disease
- Amyotrophic lateral sclerosis (ALS)
- Pseudotumor Cerebrii
- Normal pressure hydrocephalus

### **CSF cell count**

#### **Definition**

A CSF cell count is a test to measure the number of red and white blood cells that are in cerebrospinal fluid (CSF). CSF is a clear fluid that is in the space around the spinal cord and brain.

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

A lumbar puncture (spinal tap) is the most common way to collect this sample. Rarely, other methods are used for collecting CSF such as:

- Cisternal puncture
- Ventricular puncture

- Removal of CSF from a tube that is already in the CSF, such as a shunt or ventricular drain.

After the sample is taken, it is sent to a lab for evaluation.

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

The CSF cell count may help detect:

- Meningitis and infection of the brain or spinal cord
- Tumor, abscess, or area of tissue death (infarct)
- Inflammation
- Bleeding into the spinal fluid (secondary to subarachnoid hemorrhage)

### **Normal Results**

The normal white blood cell count is between 0 and 5. The normal red blood cell count is 0.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your doctor about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

An increase of white blood cells indicates infection, inflammation, or bleeding into the cerebrospinal fluid. Some causes include:

- Abscess
- Encephalitis
- Hemorrhage
- Meningitis
- Multiple sclerosis
- Other infections
- Tumor

Finding red blood cells in the CSF may be a sign of bleeding. However, red blood cells in the CSF may also be due to the spinal tap needle hitting a blood vessel.

Additional conditions which this test may help diagnose include:

- Arteriovenous malformation (cerebral)
- Cerebral aneurysm
- Delirium
- Guillain-Barré syndrome
- Stroke
- Neurosyphilis
- Primary lymphoma of the brain
- Seizure disorders, including epilepsy
- Spinal tumor

### **CSF coccidioides complement fixation test**

#### **Definition**

CSF coccidioides complement fixation is a test that checks for infection due to the fungus coccidioides in the cerebrospinal (CSF) fluid. This is the fluid surrounding the brain and spine.

The name of this infection is coccidioidomycosis, or valley fever. When the infection involves the covering of the brain and spinal cord (the meninges), it is called coccidioidal meningitis.

#### **Alternative Names**

Coccidioides antibody test - spinal fluid

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

A sample of spinal fluid is needed for this test. The sample is usually obtained by lumbar puncture (spinal tap).

The sample is sent to a laboratory. There, it is examined for coccidioides antibodies using a laboratory method called complement fixation. This technique checks if your body has produced substances called antibodies to a specific foreign substance (antigen), in this case coccidioides.

Antibodies are specialized proteins that defend your body against bacteria, viruses, and fungi. If the antibodies are present, they stick, or "fix" themselves, to the antigen. This is why the test is called "fixation."

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

Follow your health care provider's instructions on how to prepare for the test. Expect to be in the hospital for several hours afterward.

### **How the Test will Feel**

During the test:

- You lie on your side with knees pulled up toward your chest and chin tucked downward. Or, you sit up, but bent forward.
- After your back is cleaned, the doctor injects a local numbing medicine (anesthetic) into your lower spine.
- A spinal needle is inserted, usually into the lower back area.
- Once the needle is properly positioned, CSF pressure is measured and a sample is collected.
- The needle is removed, the area is cleaned, and a bandage is placed over the needle site.
- You are taken to a recovery area where you rest for several hours to prevent any CSF leakage.

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

This test checks if your central nervous system has an active infection from *coccidioides*.

### **Normal Results**

The absence of fungus (a negative test) is normal.

### **What Abnormal Results Mean**

If the test is positive for fungus, there may be an active infection in the central nervous system. An abnormal spinal fluid test means that the central nervous system is infected. During the early stage of an illness, few antibodies may be detected. Antibody production increases during the course of an infection. For this reason, this test may be repeated several weeks after the first test.

### **Risks**

Risks of lumbar puncture include:

- Bleeding into the spinal canal
- Discomfort during the test
- Headache after the test
- Hypersensitivity (allergic) reaction to the anesthetic
- Infection introduced by the needle going through the skin
- Damage to the nerves in the spinal cord, especially if the person moves during the test

### **CSF glucose test**

#### **Definition**

A CSF glucose test measures the amount of sugar (glucose) in the cerebrospinal fluid (CSF). CSF is a clear fluid that flows in the space surrounding the spinal cord and brain.

#### **Alternative Names**

Glucose test - CSF; Cerebrospinal fluid glucose test

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

A sample of CSF is needed. A lumbar puncture, also called a spinal tap, is the most common way to collect this sample.

Other methods for collecting CSF are rarely used, but may be recommended in some cases. They include:

- Cisternal puncture
- Ventricular puncture
- Removal of CSF from a tube that is already in the CSF, such as a shunt or ventricular drain

The sample is sent to a laboratory for testing.

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

This test may be done to diagnose:

- Tumors
- Infections
- Inflammation of the central nervous system
- Delirium
- Other neurological and medical conditions

#### **Normal Results**

The glucose level in the CSF should be 50 to 80 mg/100 mL (or greater than 2/3 of the blood sugar level).

Note: Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

Abnormal results include higher and lower glucose levels. Abnormal results may be due to:

- Infection (bacterial or fungus)
- Inflammation of the central nervous system
- Tumor

#### **CSF myelin basic protein**

##### **Definition**

CSF myelin basic protein is a test to measure the level of myelin basic protein (MBP) in the cerebrospinal fluid (CSF).

CSF is a clear liquid that surrounds the brain and spinal cord.

MBP is found in the material that covers many of your nerves.

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

A sample of spinal fluid is needed. This is done using a lumbar puncture.

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

This test is done to see if myelin is breaking down. Multiple sclerosis is the most common cause for this, but other causes may include:

- Bleeding of the central nervous system
- Central nervous system trauma
- Certain brain diseases (encephalopathies)
- Infection of the central nervous system
- Stroke

##### **Normal Results**

In general, there should be less than 4 ng/mL of myelin basic protein in the CSF.

Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The example above shows the common measurement result for this test. Some laboratories use different measurements or may test different specimens.

#### **What Abnormal Results Mean**

Myelin basic protein levels between 4 and 8 ng/mL may be a sign of a long-term (chronic) breakdown of myelin. It may also indicate recovery from an acute episode of myelin breakdown. If the myelin basic protein level is greater than 9 ng/mL, myelin is actively breaking down.

#### **CSF oligoclonal banding**

##### **Definition**

CSF oligoclonal banding is a test to look for inflammation-related proteins in the cerebrospinal fluid (CSF). CSF is the clear fluid that flows in the space around the spinal cord and brain.

Oligoclonal bands are proteins called immunoglobulins. The presence of these proteins indicates inflammation of the central nervous system. The presence of oligoclonal bands may point to a diagnosis of multiple sclerosis.

##### **Alternative Names**

Cerebrospinal fluid - immunofixation

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

A sample of CSF is needed. A lumbar puncture (spinal tap) is the most common way to collect this sample.

Other methods for collecting CSF are rarely used, but may be recommended in some cases. They include:

- Cisternal puncture
- Ventricular puncture
- Removal of CSF from a tube that is already in the CSF, such as a shunt or ventricular drain.

After the sample is taken, it is sent to a lab for testing.

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

This test helps support the diagnosis of multiple sclerosis (MS). However, it does not confirm the diagnosis. Oligoclonal bands in the CSF may also be seen in other illnesses such as:

- Systemic lupus erythematosus
- Human immunodeficiency virus (HIV) infection
- Stroke

### **Normal Results**

Normally, one or no bands should be found in the CSF.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

There are two or more bandings found in the CSF and not in the blood. This may be a sign of multiple sclerosis or other inflammation.

### **CSF smear**

#### **Definition**

A cerebrospinal fluid (CSF) smear is a laboratory test to look for bacteria, fungi, and viruses in the fluid that moves in the space around the spinal cord and brain. CSF protects the brain and spinal cord from injury.

#### **Alternative Names**

Spinal fluid smear; Cerebrospinal fluid smear

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

A sample of CSF is needed. This is usually done with a lumbar puncture, or a spinal tap.

The sample is sent to a laboratory. There, a tiny amount is spread on a glass slide. Laboratory staff then views the sample under a microscope. The smear shows the color of the fluid and the number and shape of cells present in the fluid. Other tests may be done to check for bacteria or fungi in the sample.

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

Follow instructions on how to prepare for a spinal tap.

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

Your health care provider may order this test if you have signs of an infection that affects the brain or nervous system. The test helps identify what is causing the infection. This will help your provider decide on the best treatment.

#### **Normal Results**

A normal test result means there are no signs of an infection. This is also called a negative result. However, a normal result doesn't mean that there is no infection. The spinal tap and CSF smear may need to be done again.

#### **What Abnormal Results Mean**

Bacteria or other germs found in the sample may be a sign of meningitis. This is an infection of the membranes covering the brain and spinal cord. The infection can be caused by bacteria, fungi, or viruses.

#### **Risks**

A laboratory smear poses no risk. Your provider will tell you about the risks of a spinal tap.

### **CSF total protein**

#### **Definition**

CSF total protein is a test to determine the amount of protein in cerebrospinal fluid (CSF). CSF is a clear fluid that is in the space around the spinal cord and brain.

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

A sample of CSF is needed [1 to 5 milliliters (ml)]. A lumbar puncture (spinal tap) is the most common way to collect this sample. Rarely, other methods are used for collecting CSF such as:

- Cisternal puncture
- Ventricular puncture

- Removal of CSF from a tube that is already in the CSF, such as a shunt or ventricular drain.

After the sample is taken, it is sent to a lab for evaluation.

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

You may have this test to help diagnose:

- Tumors
- Infection
- Inflammation of several groups of nerve cells
- Vasculitis
- Blood in the spinal fluid
- Multiple sclerosis (MS)

### **Normal Results**

The normal protein range varies from lab to lab, but is typically about 15 to 60 milligrams per deciliter (mg/dL) or 0.15 to 0.6 milligrams per milliliter (mg/mL).

Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

An abnormal protein level in the CSF suggests a problem in the central nervous system.

Increased protein level may be a sign of a tumor, bleeding, nerve inflammation, or injury. A blockage in the flow of spinal fluid can cause the rapid buildup of protein in the lower spinal area.

A decrease in protein level can mean your body is rapidly producing spinal fluid.

### **CSF-VDRL test**

#### **Definition**

The CSF-VDRL test is used to help diagnose neurosyphilis. It looks for substances (proteins) called antibodies, which are sometimes produced by the body in reaction to the syphilis-causing bacteria.

#### **Alternative Names**

Venereal disease research laboratory slide test - CSF; Neurosyphilis - VDRL

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

A sample of spinal fluid is needed.

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

Follow the health care provider's instructions on how to prepare for this test.

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

The CSF-VDRL test is done to diagnose syphilis in the brain or spinal cord. Brain and spinal cord involvement is often a sign of late-stage syphilis.

Blood screening tests (VDRL and RPR) are better at detecting middle-stage (secondary) syphilis.

#### **Normal Results**

A negative result is normal.

False-negatives can occur. This means you can have syphilis even if this test is normal. Therefore, a negative test does not always rule out the infection. Other signs and tests may be used to diagnose neurosyphilis.

#### **What Abnormal Results Mean**

A positive result is abnormal and is a sign of neurosyphilis.

#### **Risks**

Risks for this test are those related to lumbar puncture, which may include:

- Bleeding into the spinal canal or around the brain (subdural hematomas).
- Discomfort during the test.
- Headache after the test that can last a few hours or days. If headaches last more than a few days (especially when you sit, stand or walk) you might have a CSF-leak. You should talk to your physician if this occurs.
- Hypersensitivity (allergic) reaction to the anesthetic.
- Infection introduced by the needle going through the skin.

Your provider can tell you about any other risks.



## **CT angiography - abdomen and pelvis**

### **Definition**

CT angiography combines a CT scan with the injection of dye. This technique is able to create pictures of the blood vessels in your belly (abdomen) or pelvis area. CT stands for computed tomography.

### **Alternative Names**

Computed tomography angiography - abdomen and pelvis; CTA - abdomen and pelvis; Renal artery - CTA; Aortic - CTA; Mesenteric CTA; PAD - CTA; PVD - CTA; Peripheral vascular disease - CTA; Peripheral artery disease; CTA; Claudication - CTA

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

You will lie on a narrow table that slides into the center of the CT scanner. Most often, you will lie on your back with your arms raised above your head.

Once you are inside the scanner, the machine's x-ray beam rotates around you. Modern "spiral" scanners can perform the exam without stopping.

A computer creates separate images of the belly area, called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the belly area can be made by stacking the slices together.

You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods of time.

The scan should take less than 30 minutes.

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

You need to have a special dye, called contrast, put into your body before some exams. Contrast helps certain areas show up better on the x-rays.

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you also may be asked not to eat or drink anything for 4 to 6 hours before the test.
- You may also have to drink a different contrast before the exam. When you drink the contrast will depend on the type of exam being done. Contrast has a chalky taste, although some have flavors so that they taste a little better. The contrast will pass out of your body through your stools.
- Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test in order to safely receive this substance.
- Before receiving the contrast, tell your provider if you take the diabetes medication metformin (Glucophage). People taking this medicine may have to stop taking it for a while before the test.

The contrast can worsen kidney function problems in patients with poorly functioning kidneys. Talk to your provider if you have a history of kidney problems.

Too much weight can damage the scanner. If you weigh more than 300 pounds (135 kilograms), talk to your provider about the weight limit before the test.

You will need to take off your jewelry and wear a hospital gown during the study.

### **How the Test will Feel**

Lying on the hard table may be a little bit uncomfortable.

If you have contrast through a vein, you may have a:

- Slight burning sensation
- Metallic taste in your mouth
- Warm flushing of your body

These feelings are normal and go away within a few seconds.

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

A CT angiography scan quickly makes detailed pictures of the blood vessels inside your belly or pelvis.

This test may be used to look for:

- Abnormal widening or ballooning of part of an artery (aneurysm)
- The source of bleeding that starts in the intestines or elsewhere in the belly or pelvis
- Masses and tumors in the abdomen or pelvis, including cancer, when needed to help plan treatment

- Cause of pain in the abdomen thought to be due to narrowing or blockage of one or more of the arteries that supply the small and large intestines
- Pain in the legs thought to be due to narrowing of blood vessels that supply the legs and feet
- High blood pressure due to narrowing of the arteries that carry blood to the kidneys

The test also may be used before:

- Surgery on blood vessels of liver
- Kidney transplant

### **Normal Results**

Results are considered normal if no problems are seen.

### **What Abnormal Results Mean**

The abnormal results may show:

- The source of bleeding inside the belly or pelvis
- Narrowing of the artery that supplies the kidneys
- Narrowing of arteries that supply the intestines
- Narrowing of arteries that supply the legs
- Ballooning or swelling of an artery (aneurysm), including the aorta
- A tear in the wall of the major artery carrying blood out of the heart (aorta)

### **Risks**

Risks of CT scans include:

- Allergy to contrast dye
- Exposure to radiation
- Damage to kidneys from contrast dye

CT scans expose you to more radiation than regular x-rays. Many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. Talk to your health care provider about this risk and the benefit of the test for getting a correct diagnosis of your medical problem. Most modern scanners use techniques to use less radiation.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

The most common type of contrast given into a vein contains iodine. If you have an iodine allergy, you may have nausea or vomiting, sneezing, itching, or hives if you get this type of contrast.

If you must be given such contrast, your provider may give you antihistamines (such as Benadryl) or steroids before the test.

Your kidneys help remove iodine out of the body. You may need extra fluids after the test to help flush the iodine out of your body if you have kidney disease or diabetes.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. Tell the scanner operator right away if you have any trouble breathing during the test. Scanners come with an intercom and speakers, so the operator can hear you at all times.

### **CT angiography - arms and legs**

#### **Definition**

CT angiography combines a CT scan with the injection of dye. This technique is able to create pictures of the blood vessels in the arms or legs. CT stands for computed tomography.

#### **Alternative Names**

Computed tomography angiography - peripheral; CTA - peripheral; CTA - Runoff; PAD - CT angiography; Peripheral artery disease - CT angiography; PVD - CT angiography

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

You will lie on a narrow table that slides into the center of the CT scanner.

When you are inside the scanner, the machine's x-ray beam rotates around you. Modern "spiral" scanners can perform the exam without stopping.

A computer makes multiple images of the body area, called slices. These images can be stored, viewed on a monitor, or printed on film. Models of the body area in three-dimension can be created by adding the slices together.

You must stay still during the exam, because movement blurs the pictures. You may have to hold your breath for short periods of time.

The scan should take only about 5 minutes.

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

Some exams require a special dye, called contrast, to be injected into your body before the test. Contrast helps certain areas show up better on the x-rays.

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you also may be asked not to eat or drink anything for 4 to 6 hours before the test.
- Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test to avoid this problem.
- Before receiving the contrast, tell your provider if you take the diabetes medicine metformin (Glucophage). You may need to take extra steps if you are taking this medicine.

The contrast can worsen kidney function problems in people with poorly functioning kidneys. Talk to your provider if you have a history of kidney problems.

Too much weight can cause damage to the scanner's working parts. If you weigh more than 300 pounds (135 kilograms), talk to your doctor about the weight limit before the test.

You will need to remove jewelry and wear a hospital gown during the CT exam.

### **How the Test will Feel**

Some people may be uncomfortable lying on the hard table.

Contrast given through an IV may cause a:

- Slight burning feeling
- Metallic taste in your mouth
- Warm flushing of your body

These feelings are normal and usually go away within a few seconds.

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

You may need this test if you have symptoms of a narrowed or blocked blood vessel in the arms, hands, legs, or feet.

The test may also be done to diagnose:

- Abnormal widening or ballooning of part of an artery (aneurysm)
- Bleeding
- Swelling or inflammation of the blood vessels (vasculitis)
- Leg pain during walking or exercise (claudication)

### **Normal Results**

Results are considered normal if no problems are seen.

### **What Abnormal Results Mean**

An abnormal result is commonly due to narrowing and hardening of the arteries in the arms or legs from plaque buildup in the artery walls.

The x-ray may show a blockage in the vessels caused by:

- Abnormal widening or ballooning of part of an artery (aneurysm)
- Blood clots
- Other diseases of the arteries

Abnormal results may also be due to:

- Inflammation of the blood vessels
- Injury to the blood vessels
- Buerger disease (thromboangiitis obliterans), a rare disease in which blood vessels of the hands and feet become blocked

### **Risks**

Risks of CT scans include:

- Exposure to radiation
- Allergy to contrast dye
- Damage to the kidneys from the contrast dye

CT scans give off more radiation than regular x-rays. Having many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. You and your provider should discuss this risk compared with the value of an accurate diagnosis for the problem. Most modern scanners use techniques to use less radiation.

Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast contains iodine. If you have an iodine allergy, you may have nausea or vomiting, sneezing, itching, or hives if you get this type of contrast.

- If you need to have this kind of contrast, your provider may give you antihistamines (such as Benadryl) or steroids before the test.
- The kidneys help remove iodine out of the body. You may need extra fluids after the test to help rid your body of the iodine if you have kidney disease or diabetes.

Rarely, the dye may cause a serious allergic response called anaphylaxis. This can be life-threatening. Notify the scanner operator right away if you have any trouble breathing during the test. Scanners have an intercom and speakers so the operator can hear you at all times.

### **CT angiography - chest**

#### **Definition**

CT angiography combines a CT scan with the injection of dye. This technique is able to create pictures of the blood vessels in the chest and upper abdomen. CT stands for computed tomography.

#### **Alternative Names**

Computed tomography angiography - thorax; CTA - lungs; Pulmonary embolism - CTA chest; Thoracic aortic aneurysm - CTA chest; Venous thromboembolism - CTA lung; Blood clot - CTA lung; Embolus - CTA lung; CT pulmonary angiogram

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

You will be asked to lie on a narrow table that slides into the center of the CT scanner.

While inside the scanner, the machine's x-ray beam rotates around you.

A computer creates multiple separate images of the body area, called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the chest area can be created by stacking the slices together.

You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods of time.

Complete scans usually take only a few minutes. The newest scanners can image your entire body, head to toe, in less than 30 seconds.

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

Certain exams require a special dye, called contrast, to be delivered into the body before the test starts. Contrast helps certain areas show up better on x-rays.

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.
- Let your health care provider know if you have ever had a reaction to contrast. You may need to take medications before the test in order to safely receive it.
- Before receiving the contrast, tell your provider if you take the diabetes medication metformin (Glucophage). You may need to take extra precautions.

The contrast can worsen kidney function problems in people with poorly functioning kidneys.

Talk to your provider if you have a history of kidney problems.

Too much weight can damage the scanner. If you weigh more than 300 pounds (135 kilograms), talk to your provider about the weight limit before the test.

You will be asked to remove jewelry and wear a hospital gown during the study.

#### **How the Test will Feel**

The x-rays produced by the CT scan are painless. Some people may have discomfort from lying on the hard table.

If you have contrast through a vein, you may have a:

- Slight burning feeling
- Metallic taste in your mouth
- Warm flushing of your body

This is normal and usually goes away within a few seconds.

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

A chest CT angiogram may be done:

- For symptoms that suggest blood clots in the lungs, such as chest pain, rapid breathing, or shortness of breath
- After a chest injury or trauma
- Before surgery in the lung or chest
- To look for a possible site to insert a catheter for hemodialysis

- For swelling of the face or upper arms that cannot be explained
- To look for a suspected birth defect of the aorta or other blood vessels in the chest
- To look for a balloon dilation of an artery (aneurysm)
- To look for a tear in an artery (dissection)

### **Normal Results**

Results are considered normal if no problems are seen.

### **What Abnormal Results Mean**

A chest CT may show many disorders of the heart, lungs, or chest area, including:

- Suspected blockage of the superior vena cava: This large vein moves blood from the upper half of the body to the heart.
- Blood clot(s) in the lungs.
- Abnormalities of the blood vessels in the lungs or chest, such as aortic arch syndrome.
- Aortic aneurysm (in the chest area).
- Narrowing of part of the major artery leading out of the heart (aorta).
- Tear in the wall of an artery (dissection).
- Inflammation of the blood vessel walls (vasculitis).

### **Risks**

Risks of CT scans include:

- Being exposed to radiation
- Allergic reaction to contrast dye
- Damage to kidneys from contrast dye

CT scans use more radiation than regular x-rays. Having many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. You and your provider should weigh this risk against the benefits of getting a correct diagnosis for a medical problem.

Most modern scanners use techniques to use less radiation.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast given into a vein contains iodine. If you have an iodine allergy, you may have nausea or vomiting, sneezing, itching, or hives if you get this type of contrast.
- If you absolutely must be given such contrast, your provider may give you antihistamines (such as Benadryl) or steroids before the test.
- The kidneys help remove iodine out of the body. Those with kidney disease or diabetes may need to receive extra fluids after the test to help flush the iodine out of the body.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. If you have any trouble breathing during the test, you should notify the scanner operator immediately. Scanners come with an intercom and speakers, so someone can hear you at all times.

### **CT angiography - head and neck**

#### **Definition**

CT angiography (CTA) combines a CT scan with the injection of dye. CT stands for computed tomography. This technique is able to create pictures of the blood vessels in the head and neck.

#### **Alternative Names**

Computed tomography angiography - brain; CTA - skull; CTA - cranial; TIA-CTA head; Stroke-CTA head; Computed tomography angiography - neck; CTA - neck; Vertebral artery - CTA; Carotid artery stenosis - CTA; Vertebrobasilar - CTA; Posterior circulation ischemia - CTA; TIA - CTA neck; Stroke - CTA neck

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

You will be asked to lie on a narrow table that slides into the center of the CT scanner.

While inside the scanner, the machine's x-ray beam rotates around you.

A computer creates many separate images of the body area, called slices. These images can be stored, viewed on a monitor, or printed on film. Three-dimensional models of the head and neck area can be created by stacking the slices together.

You must be still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods of time.

Complete scans usually take only a few seconds. The newest scanners can image your entire body, head to toe, in less than 30 seconds.

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

Certain exams require a special dye, called contrast, to be delivered into the body before the test starts. Contrast helps certain areas show up better on x-rays.

- Contrast can be given through a vein (IV) in your hand or forearm. If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.
- Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test in order to safely receive it.
- Before receiving the contrast, tell your provider if you take the diabetes medicine metformin (Glucophage). You may need to take extra precautions.

The contrast can worsen kidney function problems in people with poorly functioning kidneys. Talk to your provider if you have a history of kidney problems.

Too much weight can damage the scanner. If you weigh more than 300 pounds (135 kilograms), talk to your provider about the weight limit before the test.

You will be asked to remove jewelry and wear a hospital gown during the study.

### **How the Test will Feel**

Some people may have discomfort from lying on the hard table.

If you have contrast through a vein, you may have a:

- Slight burning feeling
- Metallic taste in your mouth
- Warm flushing of your body

This is normal and usually goes away within a few seconds.

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

CTA of the head may be done to look for the cause of:

- Changes in thinking or behavior
- Difficulty pronouncing words
- Dizziness or vertigo
- Double vision or vision loss
- Fainting
- Headache, when you have certain other signs or symptoms
- Hearing loss (in some people)
- Numbness or tingling, most often on the face or scalp
- Swallowing problems
- Stroke
- Transient ischemic attack (TIA)
- Weakness in one part of your body

CTA of the neck may also be done:

- After trauma to the neck to look for damage to blood vessels
- For planning before carotid artery surgery
- For planning for brain tumor surgery
- For suspected vasculitis (inflammation of the blood vessel walls)
- For suspected abnormal blood vessels in the brain

### **Normal Results**

Results are considered normal if no problems are seen.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Abnormal blood vessels (arteriovenous malformation).
- Bleeding in the brain (for example, subdural hematoma or an area of bleeding).
- Brain tumor or other growth (mass).
- Stroke.
- Narrowed or blocked carotid arteries. (The carotid arteries provide the main blood supply to your brain. They are located on each side of your neck.)
- Narrowed or blocked vertebral artery in the neck. (The vertebral arteries provide blood flow to the back of the brain.)



- A tear in the wall of an artery (dissection).
- A weak area in the wall of a blood vessel that causes the blood vessel to bulge or balloon out (aneurysm).

### **Risks**

Risks for CT scans include:

- Being exposed to radiation
- Allergic reaction to the contrast dye
- Damage to the kidneys from the dye

CT scans use more radiation than regular x-rays. Having many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. You and your provider should weigh this risk against the benefits of getting a correct diagnosis for a medical problem.

Most modern scanners use techniques to use less radiation.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast given into a vein contains iodine. If you have an iodine allergy, you may have nausea or vomiting, sneezing, itching, or hives if you get this type of contrast.
- If you absolutely must be given such contrast, your provider may give you antihistamines (such as Benadryl) or steroids before the test.
- The kidneys help remove iodine out of the body. People with kidney disease or diabetes may need to receive extra fluids after the test to help flush the iodine out of the body.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. Tell the scanner operator right away if you have any trouble breathing during the test. Scanners come with an intercom and speakers, so the operator can hear you at all times.

### **Considerations**

A CT scan can reduce or avoid the need for invasive procedures to diagnose problems in the skull. This is one of the safest ways to study the head and neck.

Other tests that may be done instead of CT scan of the head include:

- MRI of the head
- Positron emission tomography (PET) scan of the head

### **CT scan**

#### **Definition**

A computed tomography (CT) scan is an imaging method that uses x-rays to create pictures of cross-sections of the body.

Related tests include:

- Abdominal and pelvis CT scan
- Cranial or head CT scan
- Cervical, thoracic, and lumbosacral spine CT scan
- Orbit CT scan
- Chest CT scan

#### **Alternative Names**

CAT scan; Computed axial tomography scan; Computed tomography scan

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

You will be asked to lie on a narrow table that slides into the center of the CT scanner.

Once you are inside the scanner, the machine's x-ray beam rotates around you. Modern spiral scanners can perform the exam without stopping.

A computer creates separate images of the body area, called slices. These images can be stored, viewed on a monitor, or copied to a disk. Three-dimensional models of the body area can be created by stacking the slices together.

You must stay still during the exam, because movement causes blurred images. You may be told to hold your breath for short periods of time.

Complete scans most often take only a few minutes. The newest scanners can image your entire body in less than 30 seconds.

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

Certain exams require a special dye, called contrast, to be delivered into your body before the test starts. Contrast helps certain areas show up better on the x-rays.

Let your health care provider know if you have ever had a reaction to contrast. You may need to take medicines before the test in order to avoid another reaction.

Contrast can be given several ways, depending on the type of CT being performed.

- It may be delivered through a vein (IV) in your hand or forearm.
- You might drink the contrast before your scan. When you drink the contrast depends on the type of exam being done. The contrast liquid may taste chalky, although some are flavored. The contrast passes out of your body through your stools.
- Rarely, the contrast may be given into your rectum using an enema.

If contrast is used, you may also be asked not to eat or drink anything for 4 to 6 hours before the test.

Before receiving IV contrast, tell your provider if you take the diabetes medication metformin (Glucophage). People taking this medicine may need to stop temporarily. Also let your provider know if you have any problems with your kidneys. The IV contrast can worsen kidney function. Find out if the CT machine has a weight limit if you weigh more than 300 pounds (135 kilograms). Too much weight can damage the scanner.

You will need to remove jewelry and wear a gown during the study.

### **How the Test will Feel**

Some people may have discomfort from lying on the hard table.

Contrast given through an IV may cause a slight burning feeling, a metallic taste in the mouth, and a warm flushing of the body. These sensations are normal and usually go away within a few seconds.

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

A CT scan creates detailed pictures of the body, including the brain, chest, spine, and abdomen.

The test may be used to:

- Diagnose an infection
- Guide a doctor to the right area during a biopsy
- Identify masses and tumors, including cancer
- Study blood vessels

### **Normal Results**

Results are considered normal if the organs and structures being examined are normal in appearance.

### **What Abnormal Results Mean**

Abnormal results depend on the part of the body being studied. Talk to your provider about questions and concerns.

### **Risks**

Risks of having CT scans include:

- Allergic reaction to the contrast dye
- Damage to kidney function from the contrast dye
- Exposure to radiation

CT scans expose you to more radiation than regular x-rays. Having many x-rays or CT scans over time may increase your risk for cancer. However, the risk from any one scan is small. You and your doctor should weigh this risk against the value of the information that will come from a CT scan. Most new CT scan machines have the ability to reduce the radiation dose.

Some people have allergies to contrast dye. Let your provider know if you have ever had an allergic reaction to injected contrast dye.

- The most common type of contrast given into a vein contains iodine. If you have an iodine allergy, contrast may cause nausea or vomiting, sneezing, itching, or hives.
- If you absolutely must be given such contrast, your doctor may give you antihistamines (such as Benadryl) or steroids before the test.
- Your kidneys help remove iodine from the body. You may need to receive extra fluids after the test to help flush iodine out of your body if you have diabetes or kidney disease.

Rarely, the dye may cause a life-threatening allergic response called anaphylaxis. If you have any trouble breathing during the test, tell the scanner operator immediately. Scanners come with an intercom and speakers, so the operator can hear you at all times.

### **Culdocentesis**

#### **Definition**

Culdocentesis is a procedure that checks for abnormal fluid in the space just behind the vagina. This area is called the cul-de-sac.

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

First, you will have a pelvic exam. Then, the health care provider will hold the cervix with an instrument and lift it slightly.

A long, thin needle is inserted through the wall of the vagina (just below the uterus). A sample is taken of any fluid found in the space. The needle is pulled out.

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

You may be asked to walk or sit for a short time before the test is done.

#### **How the Test will Feel**

You may have an uncomfortable, cramping feeling. You will feel a brief, sharp pain as the needle is inserted.

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

This procedure is rarely done today because a transvaginal ultrasound can show fluid behind the uterus.

It may be done when:

- You have pain in the lower abdomen and pelvis, and other tests suggest there is fluid in the area.
- You may have a ruptured ectopic pregnancy or ovarian cyst.
- Blunt abdominal trauma.

#### **Normal Results**

No fluid in the cul-de-sac, or a very small amount of clear fluid, is normal.

#### **What Abnormal Results Mean**

Fluid may still be present, even if not seen with this test. You may need other tests.

A sample of fluid may be taken and tested for infection.

If blood is found in the fluid sample, you may need emergency surgery.

#### **Risks**

Risks include puncturing the uterine or bowel wall.

#### **Considerations**

You may need someone to take you home if you were given medicines to relax.

### **Culture - colonic tissue**

#### **Definition**

A colonic tissue culture is a lab test to check for the cause of disease. The sample of tissue for the test is taken from the large intestine. The cause may be bacteria, fungi, or viruses.

#### **Alternative Names**

Colonic tissue culture

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

The health care provider removes a piece of tissue from your large intestine. This is done during a colonoscopy.

- The sample is sent to a lab.
- It is placed in a special dish that contains a gel. Bacteria and other organisms can grow in this gel. The dish is then stored at a certain temperature.
- The lab team checks the sample daily. They check to see if bacteria, viruses, or fungi have grown.

If certain germs grow, more tests will be done to identify them. This helps decide the best treatment.

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

There is no specific preparation needed for a culture.

#### **How the Test will Feel**

Once the sample is taken, the culture does not involve you. Therefore, there is no pain.

**Why the Test is Performed**

Your provider may order this test if you have signs or symptoms of a large intestine infection. A culture is often done when other tests such as a stool culture could not identify the cause of infection.

**Normal Results**

A normal result means that no disease-causing organisms have grown in the lab dish.

Some "healthy" bacteria, called bowel flora, are normally found in the gut. The growth of such bacteria during this test does not mean there is an infection.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about your test results.

**What Abnormal Results Mean**

An abnormal result means that disease-causing organisms have grown in the lab dish. These organisms may include:

- *Clostridium difficile* bacteria
- Cytomegalovirus
- *Mycobacterium tuberculosis* bacteria
- Salmonella bacteria
- Shigella bacteria

These organisms may lead to diarrhea or colon infections.

**Risks**

There are no risks in a colonic tissue culture.

**Culture - duodenal tissue****Definition**

A duodenal tissue culture is a laboratory exam to check a piece of tissue from the first part of the small intestine (duodenum). The test is to look for organisms that cause infection.

**Alternative Names**

Duodenal tissue culture

**How the Test is Performed**

A piece of tissue from the first part of the small intestine is taken during an upper endoscopy (esophagogastroduodenoscopy).

The sample is then sent to a lab. There it is placed in a special dish (culture media) that allows bacteria or viruses to grow. The sample is looked at under a microscope regularly to see if any organisms are growing.

Organisms that grow on the culture are identified.

**How to Prepare for the Test**

This is a test done in a lab. The sample is collected during an upper endoscopy and biopsy procedure (esophagogastroduodenoscopy). Ask your health care provider how to prepare for this procedure.

**Why the Test is Performed**

A culture of duodenal tissue is done to check for bacteria or viruses that may lead to certain illnesses and conditions.

**Normal Results**

No harmful bacteria or viruses are found.

**What Abnormal Results Mean**

An abnormal finding means that harmful bacteria or a virus has been found in the tissue sample. Bacteria may include:

- Campylobacter
- *Helicobacter pylori* (*H pylori*)
- Salmonella

**Considerations**

Other tests are very often done to look for infection-causing organisms in duodenal tissue. These tests include the urease test (for example, the CLO test) and histology (looking at the tissue under a microscope).

Routine culture for *H pylori* is not currently recommended.

## **Cystometric study**

### **Definition**

Cystometric study measures the amount of fluid in the bladder when you first feel the need to urinate, when you are able to sense fullness, and when your bladder is completely full.

### **Alternative Names**

CMG; Cystometrogram

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

Prior to the cystometric study, you may be asked to urinate (void) into a special container that is interfaced with a computer. This type of study is called a uroflow, during which the following will be recorded by the computer:

- The time it takes you to begin urinating
- The pattern, speed, and continuity of your urinary stream
- The amount of urine
- How long it took you to empty your bladder

You will then lie down, and a thin, flexible tube (catheter) is gently placed in your bladder. The catheter measures any urine left in the bladder. A smaller catheter is sometimes placed in your rectum in order to measure abdominal pressure. Measuring electrodes, similar to the sticky pads used for an ECG, are placed near the rectum.

A tube used to monitor bladder pressure (cystometer) is attached to the catheter. Water flows into the bladder at a controlled rate. You will be asked to tell the health e provider when you first feel the need to urinate and when you feel that your bladder is completely full.

Often, your provider may need more information and will order tests to evaluate your bladder function. This set of tests is often referred to as urodynamics or complete urodynamics. The combination includes three tests:

- Measured voiding without a catheter (uroflow)
- Cystometry (filling phase)
- Voiding or emptying phase test

For complete urodynamic testing, a much smaller catheter is placed in the bladder. You will be able to urinate around it. Because this special catheter has a sensor on the tip, the computer can measure the pressure and volumes as your bladder fills and as you empty it. You may be asked to cough or push so that the provider can check for urine leakage. This type of complete testing can reveal a lot of information about your bladder function.

For even more information, x-rays can be taken during the test. In this case, instead of water, a special fluid (contrast) that shows on an x-ray is used to fill your bladder. This type of urodynamics is called videourodynamics.

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

No special preparations are needed for this test.

For infants and children, preparation depends on the child's age, past experiences, and level of trust. For general information regarding how you can prepare your child, see the following topics:

- Preschooler test or procedure preparation (3 to 6 years)
- School age test or procedure preparation (6 to 12 years)
- Adolescent test or procedure preparation (12 to 18 years)

### **How the Test will Feel**

There is some discomfort associated with this test. You may experience:

- Bladder filling
- Flushing
- Nausea
- Pain
- Sweating
- Urgent need to urinate
- Burning

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

The test will help determine the cause of bladder voiding dysfunction.

### **Normal Results**

Normal results vary and should be discussed with your provider.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Enlarged prostate
- Multiple sclerosis
- Overactive bladder
- Reduced bladder capacity
- Spinal cord injury
- Stroke
- Urinary tract infection

### **Risks**

There is a slight risk of urinary tract infection and blood in the urine.

### **Considerations**

This test should not be done if you have a known urinary tract infection. Existing infection increases the possibility of false test results. The test itself increases the possibility of spreading the infection.

### **Cystoscopy**

#### **Definition**

Cystoscopy is a surgical procedure. This is done to see the inside of the bladder and urethra using a thin, lighted tube.

#### **Alternative Names**

Cystourethroscopy; Endoscopy of the bladder

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

Cystoscopy is done with a cystoscope. This is a special tube with a small camera on the end (endoscope). There are two types of cystoscopes:

- Standard, rigid cystoscope
- Flexible cystoscope

The tube can be inserted in different ways. However, the test is the same. The type of cystoscope your health care provider will use depends on the purpose of the exam.

The procedure will take about 5 to 20 minutes. The urethra is cleansed. A numbing medicine is applied to the skin lining the inside of the urethra. This is done without needles. The scope is then inserted through the urethra into the bladder.

Water or salt water (saline) flows through the tube to fill the bladder. As this occurs, you may be asked to describe the feeling. Your answer will give some information about your condition.

As fluid fills the bladder, it stretches the bladder wall. This lets your provider see the entire bladder wall. You will feel the need to urinate when the bladder is full. However, the bladder must stay full until the exam is finished.

If any tissue looks abnormal, a small sample can be taken (biopsy) through the tube. This sample will be sent to a lab to be tested.

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

Ask your provider if you should stop taking any medicines that could thin your blood.

The procedure may be done in a hospital or surgery center. In that case, you will need to have someone take you home afterward.

#### **How the Test will Feel**

You may feel slight discomfort when the tube is passed through the urethra into the bladder. You will feel an uncomfortable, strong need to urinate when your bladder is full.

You may feel a quick pinch if a biopsy is taken. After the tube is removed, the urethra may be sore. You may have blood in the urine and a burning sensation during urination for a day or two.

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

The test is done to:

- Check for cancer of the bladder or urethra
- Diagnose the cause of blood in the urine
- Diagnose the cause of problems passing urine
- Diagnose the cause of repeated bladder infections
- Help determine the cause of pain during urination

### **Normal Results**



The bladder wall should look smooth. The bladder should be of normal size, shape, and position. There should be no blockages, growths, or stones.

#### **What Abnormal Results Mean**

The abnormal results could indicate:

- Bladder cancer
- Bladder stones (calculi)
- Bladder wall decompression
- Chronic urethritis or cystitis
- Scarring of the urethra (called a stricture)
- Congenital (present at birth) abnormality
- Cysts
- Diverticula of the bladder or urethra
- Foreign material in the bladder or urethra

Some other possible diagnoses may be:

- Irritable bladder
- Polyps
- Prostate problems, such as bleeding, enlargement, or blockage
- Traumatic injury of the bladder and urethra
- Ulcer
- Urethral strictures

#### **Risks**

There is a slight risk for excess bleeding when a biopsy is taken.

Other risks include:

- Bladder infection
- Rupture of the bladder wall

#### **Considerations**

Drink 4 to 6 glasses of water per day after the procedure.

You may notice a small amount of blood in your urine after this procedure. If the bleeding continues after you urinate 3 times, contact your provider.

Contact your provider if you develop any of these signs of infection:

- Chills
- Fever
- Pain
- Reduced urine output

#### **Cytology exam of pleural fluid**

##### **Definition**

A cytology exam of pleural fluid is a laboratory test to detect cancer cells and certain other cells in the area that surrounds the lungs. This area is called the pleural space. Cytology means the study of cells.

##### **Alternative Names**

Pleural fluid cytology; Lung cancer - pleural fluid

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

A sample of fluid from the pleural space is needed. The sample is taken using a procedure called thoracentesis.

The procedure is done in the following way:

- You sit on a bed or on the edge of a chair or bed. Your head and arms rest on a table.
- A small area of skin on your back is cleaned. Numbing medicine (local anesthetic) is injected in this area.
- The doctor inserts a needle through the skin and muscles of the chest wall into the pleural space.
- Fluid is collected.
- The needle is removed. A bandage is placed on the skin.

The fluid sample is sent to a laboratory. There, it is examined under the microscope to determine what the cells look like and whether they are abnormal.

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

No special preparation is needed before the test. A chest x-ray will likely be done before and after the test.

DO NOT cough, breathe deeply, or move during the test to avoid injury to the lung.

#### **How the Test will Feel**

You will feel stinging when the local anesthetic is injected. You may feel pain or pressure when the needle is inserted into the pleural space.

Tell your health care provider if you feel short of breath or have chest pain.

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

A cytology exam is used to look for cancer and precancerous cells. It may also be done for other conditions, such as identifying systemic lupus erythematosus cells.

Your doctor may order this test if you have signs of fluid buildup in the pleural space. This condition is called pleural effusion. The test may also be done if you have signs of lung cancer.

#### **Normal Results**

Normal cells are seen.

#### **What Abnormal Results Mean**

In an abnormal test, there are cancerous (malignant) cells. This may mean there is a cancerous tumor. This test most often detects:

- Breast cancer
- Lymphoma
- Lung cancer
- Ovarian cancer
- Stomach cancer

#### **Risks**

Risks are related to thoracentesis and may include:

- Bleeding
- Infection
- Collapse of the lung (pneumothorax)
- Difficulty breathing

### **Cytology exam of urine**

#### **Definition**

A cytology exam of urine is a test used to detect cancer and other diseases of the urinary tract.

#### **Alternative Names**

Urine cytology; Bladder cancer - cytology; Urethral cancer - cytology; Renal cancer - cytology

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

Most of the time, the sample is collected as a clean catch urine sample in your doctor's office or at home. This is done by urinating into a special container. The clean-catch method is used to prevent germs from the penis or vagina from getting into a urine sample. To collect your urine, you may get a special clean-catch kit from your health care provider that contains a cleansing solution and sterile wipes. Follow instructions exactly.

The urine sample can also be collected during cystoscopy. During this procedure, your provider uses a thin, tube-like instrument with a camera on the end to examine the inside of your bladder. The urine sample is sent to a lab and examined under a microscope to look for abnormal cells.

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

No special preparation is needed.

#### **How the Test will Feel**

There is no discomfort with a clean catch urine specimen. During cystoscopy, there may be slight discomfort when the scope is passed through the urethra into the bladder.

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

The test is done to detect cancer of the urinary tract. It is often done when blood is seen in the urine.

It is also useful for monitoring people who have a history of urinary tract cancer. The test may sometimes be ordered for people who are at high risk for bladder cancer.

This test can also detect cytomegalovirus and other viral diseases.

#### **Normal Results**

The urine shows normal cells.

### **What Abnormal Results Mean**

Abnormal cells in the urine may be a sign of inflammation of the urinary tract or cancer of the kidney, ureters, bladder, or urethra. Abnormal cells may also be seen if someone has had radiation therapy near the bladder, such as for prostate cancer, uterine cancer, or colon cancer.

Be aware that cancer or inflammatory disease cannot be diagnosed with this test alone. The results need to be confirmed with other tests or procedures.

### **Risks**

There are no risks with this test.

### **D-dimer test**

#### **Definition**

D-dimer tests are used to check for blood clotting problems. Blood clots can cause health problems, such as:

- Deep vein thrombosis (DVT)
- Pulmonary embolism (PE)
- Stroke
- Disseminated intravascular coagulation (DIC)

#### **Alternative Names**

Fragment D-dimer; Fibrin degradation fragment; DVT - D-dimer; PE - D-dimer; Deep vein thrombosis - D-dimer; Pulmonary embolism - D-dimer; Blood clot to the lungs - D-dimer

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

The D-dimer test is a blood test. You will need to get a blood sample drawn.

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing or a slight bruise.

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

Your health care provider may order a D-dimer test if you are showing symptoms of blood clots, such as:

- Swelling, pain, warmth, and changes in skin color of your leg
- Sharp chest pain, trouble breathing, coughing up blood, and fast heart beat
- Bleeding gums, nausea and vomiting, seizures, severe stomach and muscle pain, and decreased urine

Your provider may also use the D-dimer test to see if treatment for DIC is working.

#### **Normal Results**

A normal test is negative. This means that you probably do not have problems with blood clotting. If you are getting the D-dimer test to see if treatment is working for DIC, a normal or decreasing level of D-dimer means the treatment is working.

### **What Abnormal Results Mean**

A positive test means that you may be making blood clots. The test does not tell where the clots are or why you are making clots. Your provider may order other tests to see where clots are located.

A positive test may be caused by other factors, and you may not have any clots. D-dimer levels can be positive due to:

- Pregnancy
- Liver disease
- Recent surgery or trauma
- High lipid or triglyceride levels
- Heart disease
- Being over 80 years old

This makes the test mostly useful when it is negative, when many of the above causes can be ruled out.

### **Risks**

Veins vary in size from one person 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.

Risks of having blood drawn are slight, but may include:

- Excessive bleeding
- Multiple punctures to locate veins
- Fainting or feeling lightheaded
- Blood accumulating under the skin (hematoma)
- Infection (a slight risk any time the skin is broken)

### **Delta-ALA urine test**

#### **Definition**

Delta-ALA is a protein (amino acid) produced by the liver. A test can be done to measure the amount of this substance in the urine.

#### **Alternative Names**

Delta-aminolevulinic acid

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

Your health care provider will ask you to collect your urine at home over 24 hours. This is called a 24-hour urine sample. Your provider will tell you how to do this. Follow instructions exactly.

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

Your provider may tell you to temporarily stop taking any medicines that can affect test results. Be sure to tell your provider about all the medicines you take. These include:

- Penicillin (an antibiotic)
- Barbiturates (medicines to treat anxiety)
- Birth control pills
- Griseofulvin (medicine to treat fungal infections)

#### **How the Test will Feel**

The test involves only normal urination. There is no discomfort.

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

This test looks for an increased level of delta-ALA. It may be used to help diagnose a blood disorder called porphyria.

#### **Normal Results**

Normal value range for adults is 1.0 to 7.0 mg (7.6 to 53.3 mol/L) over 24 hours.

Normal value ranges may vary slightly from one lab to another. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

An increased level of urinary delta-ALA may indicate:

- Lead poisoning
- Porphyria (several types)

A decreased level may occur with chronic (long-term) liver disease.

#### **Risks**

There are no risks with this test.

### **Dental plaque identification at home**

#### **Definition**

Plaque is a soft and sticky substance that collects around and between teeth. The home dental plaque identification test shows where plaque builds up. This helps you know how well you are brushing and flossing your teeth.

Plaque is the major cause of tooth decay and gum disease (gingivitis). It is hard to see with the naked eye because it is whitish colored, like teeth.

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

There are two ways to perform this test.

- One method uses special tablets that contain a red dye that stains the plaque. You chew 1 tablet thoroughly, moving the mixture of saliva and dye over your teeth and gums for about 30 seconds. Then rinse your mouth with water and examine your teeth. Any red-stained areas are plaque. A small dental mirror may help you check all areas.
- The second method uses a plaque light. You swirl a special fluorescent solution around your mouth. Then rinse your mouth gently with water. Examine your teeth and gums while shining an ultraviolet plaque light into your mouth. The light will make any plaque look

bright yellow-orange. The advantage of this method is that it leaves no red stains in your mouth.

In the office, dentists are often able to detect plaque by doing a thorough exam with dental tools.

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

Brush and floss your teeth thoroughly.

### **How the Test will Feel**

Your mouth may feel slightly dried out after using the dye.

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

The test helps identify missed plaque. It can encourage you to improve your brushing and flossing so that you remove more plaque from your teeth. Plaque that remains on your teeth can cause tooth decay or make your gums bleed easily and become red or swollen.

### **Normal Results**

No plaque or food debris will be seen on your teeth.

### **What Abnormal Results Mean**

The tablets will stain areas of plaque dark red.

The plaque light solution will color the plaque a bright orange-yellow.

The colored areas show where brushing and flossing was not sufficient. These areas need to be brushed again to get rid of the stained plaque.

### **Risks**

There are no risks.

### **Considerations**

The tablets may cause a temporary pink coloring of your lips and cheeks. They may color your mouth and tongue red. Dentists suggest using them at night so that the color will be gone by morning.

### **Dental x-rays**

#### **Definition**

Dental x-rays are a type of image of the teeth and mouth. X-rays are a form of high energy electromagnetic radiation. The x-rays penetrate the body to form an image on film or screen. X-rays can be either digital or developed on a film.

Structures that are dense (such as silver fillings or metal restoration) will block most of the light energy from the x-ray. This makes them appear white in the image. Structures that contain air will be black and teeth, tissue, and fluid will appear as shades of gray.

#### **Alternative Names**

X-ray - teeth; Radiograph - dental; Bitewings; Periapical film; Panoramic film; Cephalometric x-ray; Digital image

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

The test is performed in the dentist's office. There are many types of dental x-rays. Some of them are:

- Bitewing. Shows the crown portions of the top and bottom teeth together when the person bites on a biting tab.
- Periapical. Shows 1 or 2 complete teeth from crown to root.
- Palatal (also called occlusal). Captures all the upper or lower teeth in one shot while the film rests on the biting surface of the teeth.
- Panoramic. Requires a special machine that rotates around the head. The x-ray captures all of the jaws and teeth in one shot. It is used to plan treatment for dental implants, check for impacted wisdom teeth, and detect jaw problems. A panoramic x-ray is not the best method for detecting cavities, unless the decay is very advanced and deep.
- Cephalometric. Presents the side view of the face and represents relationship of the jaw to each other as well as to the rest of the structures. It is helpful to diagnose any airway problems.

Many dentists are also taking x-rays using digital technology. These images run through a computer. The amount of radiation given off during the procedure is less than traditional methods. Other types of dental x-rays can create a 3-D picture of the jaw. Cone beam computerized tomography (CBCT) may be used before dental surgery, such as when several implants are being placed.

**How to Prepare for the Test**

There is no special preparation. You need to remove any metal objects in the area of the x-ray exposure. A lead apron may be placed over your body. Tell your dentist if you might be pregnant.

**How the Test will Feel**

The x-ray itself causes no discomfort. Biting on the piece of film makes some people gag. Slow, deep breathing through the nose usually relieves this feeling. Both CBCT and cephalometric x-ray do not require any biting pieces.

**Why the Test is Performed**

Dental x-rays help diagnose disease and injury of the teeth and gums as well as help planning the appropriate treatment.

**Normal Results**

Normal x-rays show a normal number, structure, and position of the teeth and jaw bones. There are no cavities or other problems.

**What Abnormal Results Mean**

Dental x-rays may be used to identify the following:

- The number, size, and position of teeth
- Partially or fully impacted teeth
- The presence and severity of tooth decay (called cavities or dental caries)
- Bone damage (such as from gum disease called periodontitis)
- Abscessed teeth
- Fractured jaw
- Problems in the way the upper and lower teeth fit together (malocclusion)
- Other abnormalities of the teeth and jaw bones

**Risks**

There is very low radiation exposure from dental x-rays. However, no one should receive more radiation than necessary. A lead apron can be used to cover the body and reduce radiation exposure. Pregnant women should not have x-rays taken unless necessary.

**Considerations**

Dental x-rays can reveal dental cavities before they are clinically visible, even to the dentist. Many dentists will take yearly bitewings to look for early development of cavities in between the teeth.

**Dexamethasone suppression test****Definition**

Dexamethasone suppression test measures whether adrenocorticotrophic hormone (ACTH) secretion by the pituitary can be suppressed.

**Alternative Names**

DST; ACTH suppression test; Cortisol suppression test

**How the Test is Performed**

During this test, you will receive dexamethasone. This is a strong man-made (synthetic) glucocorticoid medicine. Afterward, your blood is drawn so that the cortisol level in your blood can be measured.

There are two different types of dexamethasone suppression tests: low dose and high dose. Each type can either be done in an overnight (common) or standard (3-day) method (rare). There are different processes that may be used for either test. Examples of these are described below.

Common:

- Low-dose overnight -- You will get 1 milligram (mg) of dexamethasone at 11 p.m., and a health care provider will draw your blood the next morning at 8 a.m. for a cortisol measurement.
- High-dose overnight -- The provider will measure your cortisol on the morning of the test. Then you will receive 8 mg of dexamethasone at 11 p.m. Your blood is drawn the next morning at 8 a.m. for a cortisol measurement.

Rare:

- Standard low-dose -- Urine is collected over 3 days (stored in 24-hour collection containers) to measure cortisol. On day 2, you will get a low dose (0.5 mg) of dexamethasone by mouth every 6 hours for 48 hours.



- Standard high-dose -- Urine is collected over 3 days (stored in 24-hour collection containers) for measurement of cortisol. On day 2, you will receive a high dose (2 mg) of dexamethasone by mouth every 6 hours for 48 hours.

Read and follow the instructions carefully. The most common cause of an abnormal test result is when instructions are not followed.

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

The provider may tell you to stop taking certain medicines that can affect the test, including:

- Antibiotics
- Anti-seizure drugs
- Medicines that contain corticosteroids, such as hydrocortisone, prednisone
- Estrogen
- Oral birth control (contraceptives)
- Water pills (diuretics)

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is done when the provider suspects that your body is producing too much cortisol. It is done to help diagnose Cushing syndrome and identify the cause.

The low-dose test can help tell whether your body is producing too much ACTH. The high-dose test can help determine whether the problem is in the pituitary gland (Cushing disease).

Dexamethasone is a man-made (synthetic) steroid that bids to the same receptor as cortisol.

Dexamethasone reduces ACTH release in normal people. Therefore, taking dexamethasone should reduce ACTH level and lead to a decreased cortisol level.

If your pituitary gland produces too much ACTH, you will have an abnormal response to the low-dose test. But you can have a normal response to the high-dose test.

### **Normal Results**

Cortisol level should decrease after you receive dexamethasone.

Low dose:

- Overnight -- 8 a.m. plasma cortisol lower than 1.8 micrograms per deciliter (mcg/dL) or 50 nanomoles per liter (nmol/L)
- Standard -- Urinary free cortisol on day 3 lower than 10 micrograms per day (mcg/day) or 280 nmol/L

High dose:

- Overnight -- greater than 50% reduction in plasma cortisol
- Standard -- greater than 90% reduction in urinary free cortisol

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

An abnormal response to the low-dose test may mean that you have abnormal release of cortisol (Cushing syndrome). This could be due to:

- Adrenal tumor that produces cortisol
- Pituitary tumor that produces ACTH
- Tumor in the body that produces ACTH (ectopic Cushing syndrome)

The high-dose test can help tell a pituitary cause (Cushing disease) from other causes. An ACTH blood test may also help identify the cause of high cortisol.

Abnormal results vary based on the condition causing the problem.

Cushing syndrome caused by an adrenal tumor:

- Low-dose test -- no decrease in blood cortisol
- ACTH level -- low
- In most cases, the high-dose test is not needed

Ectopic Cushing syndrome:

- Low-dose test -- no decrease in blood cortisol
- ACTH level -- high

- High-dose test -- no decrease in blood cortisol

Cushing syndrome caused by a pituitary tumor (Cushing disease)

- Low-dose test -- no decrease in blood cortisol
- High-dose test -- expected decrease in blood cortisol

False test results can occur due to many reasons, including different medicines, obesity, depression, and stress. False results are more common in women than men.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one patient to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **DHEA-sulfate test**

#### **Definition**

DHEA stands for dehydroepiandrosterone. It is a weak male hormone (androgen) produced by the adrenal glands in both men and women. The DHEA-sulfate test measures the amount of DHEA-sulfate in the blood.

#### **Alternative Names**

Serum DHEA-sulfate; Dehydroepiandrosterone-sulfate test; DHEA-sulfate - serum

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

A blood sample is needed.

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

No special preparation is necessary. However, tell your health care provider if you are taking any vitamins or supplements that contain DHEA or DHEA-sulfate.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or sting. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is done to check the function of the two adrenal glands. One of these glands sits above each kidney. They are one of the major sources of androgens in women.

Although DHEA-sulfate is the most abundant hormone in the body, its exact function is still not known.

- In men, the male hormone effect may not be important if testosterone level is normal.
- In women, DHEA contributes to normal libido and sexual satisfaction.
- DHEA may also have effects on the immune system.

The DHEA-sulfate test is often done in women who show signs of having excess male hormones. Some of these signs are male body changes, excess hair growth, oily skin, acne, irregular periods, or problems becoming pregnant.

It may also be done in women who are concerned about low libido or decreased sexual satisfaction who have pituitary or adrenal gland disorders.

The test is also done in children who are maturing too early (precocious puberty).

#### **Normal Results**

Normal blood levels of DHEA-sulfate can differ by sex and age.

Typical normal ranges for females are:

- Ages 18 to 19: 145 to 395 micrograms per deciliter (µg/dL) or 3.92 to 10.66 micromoles per liter (µmol/L)
- Ages 20 to 29: 65 to 380 µg/dL or 1.75 to 10.26 µmol/L
- Ages 30 to 39: 45 to 270 µg/dL or 1.22 to 7.29 µmol/L
- Ages 40 to 49: 32 to 240 µg/dL or 0.86 to 6.48 µmol/L
- Ages 50 to 59: 26 to 200 µg/dL or 0.70 to 5.40 µmol/L
- Ages 60 to 69: 13 to 130 µg/dL or 0.35 to 3.51 µmol/L

- Ages 69 and older: 17 to 90 µg/dL or 0.46 to 2.43 µmol/L

Typical normal ranges for males are:

- Ages 18 to 19: 108 to 441 µg/dL or 2.92 to 11.91 µmol/L
- Ages 20 to 29: 280 to 640 µg/dL or 7.56 to 17.28 µmol/L
- Ages 30 to 39: 120 to 520 µg/dL or 3.24 to 14.04 µmol/L
- Ages 40 to 49: 95 to 530 µg/dL or 2.56 to 14.31 µmol/L
- Ages 50 to 59: 70 to 310 µg/dL or 1.89 to 8.37 µmol/L
- Ages 60 to 69: 42 to 290 µg/dL or 1.13 to 7.83 µmol/L
- Ages 69 and older: 28 to 175 µg/dL or 0.76 to 4.72 µmol/L

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different specimens. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An increase in DHEA-sulfate may be due to:

- A common genetic disorder called congenital adrenal hyperplasia.
- A tumor of the adrenal gland, which can be benign or be a cancer.
- A common problem in women younger than 50, called polycystic ovary syndrome.
- Body changes of a girl in puberty happening earlier than normal.

A decrease in DHEA sulfate may be due to:

- Adrenal gland disorders that produce lower than normal amounts of adrenal hormones, including adrenal insufficiency and Addison disease
- The pituitary gland not producing normal amounts of its hormones (hypopituitarism)
- Taking glucocorticoid medicines

DHEA levels normally decline with age in both men and women. There is no reliable evidence that taking DHEA supplements prevents aging-related conditions.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

## **Diagnostic laparoscopy**

### **Definition**

Diagnostic laparoscopy is a procedure that allows a doctor to look directly at the contents of the abdomen or pelvis.

### **Alternative Names**

Laparoscopy - diagnostic; Exploratory laparoscopy

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

The procedure is usually done in the hospital or outpatient surgical center under general anesthesia (while you are asleep and pain-free). The procedure is performed in the following way:

- The surgeon makes a small cut (incision) below the belly button.
- A needle or hollow tube called a trocar is inserted into the incision. Carbon dioxide gas is passed into the abdomen through the needle or tube. The gas helps expand the area, giving the surgeon more room to work, and helps the surgeon see the organs more clearly.
- A tiny video camera (laparoscope) is then placed through the trocar and is used to see the inside of your pelvis and abdomen. More small cuts may be made if other instruments are needed to get a better view of certain organs.
- If you are having gynecologic laparoscopy, dye may be injected into your cervix so the surgeon can view the fallopian tubes.
- After the exam, the gas, laparoscope, and instruments are removed, and the cuts are closed. You will have bandages over those areas.

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

Follow instructions on not eating and drinking before surgery.

You may need to stop taking medicines, including narcotic pain relievers, on or before the day of the exam. DO NOT change or stop taking any medicines without first talking to your health care provider.

Follow any other instructions for how to prepare for the procedure.

### **How the Test will Feel**

You will feel no pain during the procedure. Afterward, the incisions may be sore. Your doctor may prescribe a pain reliever.

You may also have shoulder pain for a few days. The gas used during the procedure can irritate the diaphragm, which shares some of the same nerves as the shoulder. You may also have an increased urge to urinate, since the gas can put pressure on the bladder.

You will recover for a few hours at the hospital before going home. You will probably not stay overnight after a laparoscopy.

You will not be allowed to drive home. Someone should be available to take you home after the procedure.

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

Diagnostic laparoscopy is often done for the following:

- Find the cause of pain or a growth in the abdomen and pelvic area when x-ray or ultrasound results aren't clear.
- After an accident to see if there is injury to any organs in the abdomen.
- Before procedures to treat cancer to find out if the cancer has spread. If so, treatment will change.

### **Normal Results**

The laparoscopy is normal if there is no blood in the abdomen, no hernias, no intestinal obstruction, and no cancer in any visible organs. The uterus, fallopian tubes, and ovaries are of normal size, shape, and color. The liver is normal.

### **What Abnormal Results Mean**

Abnormal results may be due to a number of different conditions, including:

- Scar tissue inside the abdomen or pelvis (adhesions)
- Appendicitis
- Cells from inside the uterus growing in other areas (endometriosis)
- Inflammation of the gallbladder (cholecystitis)
- Ovarian cysts or cancer of the ovary
- Infection of the uterus, ovaries, or fallopian tubes (pelvic inflammatory disease)
- Signs of injury
- Spread of cancer
- Tumors
- Noncancerous tumors of the uterus such as fibroids

### **Risks**

There is a risk for infection. You may get antibiotics to prevent this complication.

There is a risk of puncturing an organ. This could cause the contents of the intestines to leak.

There may also be bleeding into the abdominal cavity. These complications could lead to immediate open surgery (laparotomy).

Diagnostic laparoscopy may not be possible if you have a swollen bowel, fluid in the abdomen (ascites), or you have had a past surgery.

### **Digital rectal exam**

#### **Definition**

A digital rectal exam is an examination of the lower rectum. The health care provider uses a gloved, lubricated finger to check for any abnormal findings.

#### **Alternative Names**

DRE

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

The provider will first look at the outside of the anus for hemorrhoids or fissures. Then the provider will put on a glove and insert a lubricated finger into the rectum. In women, this exam may be done at the same time as a pelvic exam.

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

For the test, the provider will ask you to:

- Try to relax
- Take a deep breath during the insertion of the finger into your rectum

#### **How the Test will Feel**

You may feel mild discomfort during this test.

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

This test is performed for many reasons. It may be done:

- As part of a routine yearly physical exam in both men and women
- When your provider suspects you are bleeding somewhere in your digestive tract
- When men are having symptoms that suggest the prostate is enlarged or you may have a prostate infection

In men, the test can be used to check the size of the prostate and to look for abnormal bumps or other changes of the prostate gland.

A digital rectal exam may be done to collect stool for testing for fecal occult (hidden) blood as part of screening for cancer of the rectum or colon.

#### **Normal Results**

A normal finding means the provider did not detect any problem during the exam. However, this test does not rule out all problems.

#### **What Abnormal Results Mean**

An abnormal result may be due to:

- A prostate problem, such as an enlarged prostate gland, prostate infection, or prostate cancer
- Bleeding anywhere in the digestive tract
- Cancer of the rectum or colon
- Small split or tear in the thin moist tissue lining of the anus (called anal fissure)
- An abscess, when pus collects in the area of the anus and rectum
- Hemorrhoids, swollen veins in the anus or lower part of the rectum

### **Digoxin test**

#### **Definition**

A digoxin test checks how much digoxin you have in your blood. Digoxin is a type of medicine called a cardiac glycoside. It is used to treat certain heart problems.

#### **Alternative Names**

Heart failure - digoxin test

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

A blood sample is needed.

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

Ask your health care provider whether you should take your usual medicines before the test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing where the needle was inserted.

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

The main purpose of this test is to determine the best dosage of digoxin and prevent side effects. It is important to monitor the level of digitalis medicines such as digoxin. That is because the difference between a safe treatment level and a harmful level is small.

#### **Normal Results**

In general, normal values range from 0.5 to 1.9 nanograms per milliliter of blood. But the right level for some people may vary depending on the situation.

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may mean you are getting too little or too much digoxin.

A very high value could mean that you have or are likely to develop a digoxin overdose (toxicity).

### **Risks**

Risks associated with having blood drawn are slight but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Disk replacement - lumbar spine**

#### **Definition**

Lumbar spine disk replacement is surgery of the lower back (lumbar) area. It is done to treat spinal stenosis or disc problems and allow normal movement of the backbone.

Spinal stenosis is present when:

- The space for the spinal column is narrowed.
- The openings for the nerve roots leaving the spinal column becomes narrow, placing pressure on the nerve.

#### **Alternative Names**

Lumbar disk arthroplasty; Thoracic disk arthroplasty; Artificial disk replacement; Total disk replacement; TDR; Disc arthroplasty; Disc replacement; Artificial disc

#### **Description**

During total disk replacement (TDR), the inner portion of a damaged spinal disk is replaced with an artificial disk to restore normal movement of the backbone.

Most often, surgery is done for only one disk, but at times, two levels next to each other may be replaced.

The surgery is done under general anesthesia. You will be asleep and not feel any pain.

During surgery:

- You will lie on your back on the operating table.
- Your arms are padded at the elbow area and folded in front of your chest.
- Your surgeon makes a horizontal incision (cut) on your abdomen. Doing the operation through the abdomen allows the surgeon to access the spine without disturbing the spinal nerves.
- The gut organs and blood vessels are moved to the side to get access to the backbone.
- Your surgeon removes the damaged portion of the disk and puts the new artificial disk in its place.
- All the organs are put back into place.
- The incision is closed with stitches.

The surgery takes about 2 hours to complete.

#### **Why the Procedure Is Performed**

Cushion-like disks help the spine stay mobile. Nerves in the lower spine area get compressed due to:

- Narrowing of the disk due to old injuries
- Bulging of the disk (protrusion)

Surgery for spinal stenosis, may be considered if you have severe symptoms that interfere with your daily life and do not improve with other therapy. Symptoms most often include:

- Pain that may be felt in your thigh, calf, lower back, shoulder, arms, or hands. The pain is often deep and steady.
- Pain when doing certain activities or moving your body a certain way.
- Numbness, tingling, and muscle weakness.

Talk to your health care provider about whether surgery is right for you. Not everyone with lower back pain needs surgery. Most people are first treated with medicines, physical therapy, and exercise for relief of back pain.

During traditional spinal surgery for spinal stenosis, the surgeon will need to fuse some of the bones in your spine to make your spine more stable. As a result, other parts of your spine below and above the fusion may be more likely to have disk problems in the future.



With disc replacement surgery, no fusion is needed. As a result, the spine above and below the site of surgery still has preserved movement. This movement may help prevent further disk problems.

You may be a candidate for disk replacement surgery if the following are true:

- You are not very overweight.
- Only one or two levels of your spine have this problem and other areas did not.
- You do not have a lot of arthritis in the joints of your spine.
- You have not had spine surgery in the past.
- You do not have severe pressure on the nerves of your spine.

### **Risks**

Risks of anesthesia and surgery in general are:

- Allergic reaction to medicines
- Breathing problems
- Bleeding, blood clots, and infection

Risks for TDR are:

- Increase in back pain
- Difficulty with movement
- Injury to the gut
- Blood clots in legs
- Abnormal bone formation in the muscles and tendons surrounding the spinal cord
- Sexual dysfunction (more common in men)
- Damage to the ureter and bladder
- Infection at the surgical site
- Breakage of the artificial disk
- Artificial disk may move out of place
- Loosening of the implant
- Paralysis

### **Before the Procedure**

Your provider will order an imaging test such as an MRI, CT scan, or x-ray to check if you need surgery.

Your provider will want to know if you:

- Are pregnant
- Are taking any medicines, supplements, or herbs
- Are diabetic, hypertensive, or have any other medical condition
- Are a smoker

Tell your health care provider what medicines you are taking. This includes medicines, supplements, or herbs you bought without a prescription.

During the days before the surgery:

- Prepare your home for when you leave the hospital.
- If you are a smoker, you need to stop. People who have TDR and continue to smoke may not heal as well. Ask your doctor for help quitting.
- One week before surgery, your provider may ask you to stop taking medicines that make it harder for your blood to clot. These include aspirin, ibuprofen (Advil, Motrin), naproxen (Aleve, Naprosyn).
- If you have diabetes, heart disease, or other medical problems, your surgeon will ask you to see your regular doctor.
- Talk with your doctor if you have been drinking a lot of alcohol.
- Ask your doctor which medicines you should still take on the day of the surgery.
- Let your doctor know right away if you get a cold, flu, fever, herpes breakout, or other illnesses you may have.
- You may want to visit a physical therapist to learn exercises to do before surgery.

On the day of the surgery:

- Follow instructions on not drinking or eating anything before the procedure. This may be 6 to 12 hours before surgery.
- Take the medicines your doctor told you to take with a small sip of water.
- Your provider will tell you when to arrive at the hospital. Be sure to arrive on time.

**After the Procedure**

You will stay in the hospital 2 to 3 days after surgery. Your provider will encourage you to stand and start walking as soon as the anesthesia wears off. You may have to wear a corset brace for support and faster healing. In the beginning, you'll be given clear liquids. You'll later progress to a liquid and semi-solid diet.

Your provider will ask you not to:

- Do any activity that stretches your spine too much
- Take part in activities that involve jarring, bending, and twisting such as driving and lifting heavy objects for at least 3 months after surgery

Follow instructions on how to take care of your back at home.

You can likely return to normal activities 3 months after the surgery.

**Outlook (Prognosis)**

The risk of complications are low after lumbar disk replacement. The surgery usually improves movement of the backbone better than other (spine surgeries). It is a safe procedure and pain relief occurs soon after surgery. The risk of spinal muscle (paravertebral muscle) injury is less than with other types of spine surgeries.

**Donath-Landsteiner test****Definition**

The Donath-Landsteiner test is a blood test to detect harmful antibodies related to a rare disorder called paroxysmal cold hemoglobinuria. These antibodies form and destroy red blood cells when the body is exposed to cold temperatures.

**Alternative Names**

Anti-P antibody; Paroxysmal cold hemoglobinuria - Donath-Landsteiner

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

No special preparation is needed.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

This test is done to confirm a diagnosis of paroxysmal cold hemoglobinuria.

**Normal Results**

The test is considered normal if no Donath-Landsteiner antibodies are present. This is called a negative result.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

**What Abnormal Results Mean**

Abnormal results mean Donath-Landsteiner antibodies are present. This is a sign of paroxysmal cold hemoglobinuria.

**Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

**Doppler ultrasound exam of an arm or leg****Definition**

This test uses ultrasound to look at the blood flow in the large arteries and veins in the arms or legs.

#### **Alternative Names**

Peripheral vascular disease - Doppler; PVD - Doppler; PAD - Doppler; Blockage of leg arteries - Doppler; Intermittent claudication - Doppler; Arterial insufficiency of the legs - Doppler; Leg pain and cramping - Doppler; Calf pain - Doppler; Venous Doppler - DVT

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

The test is done in the ultrasound or radiology department, a hospital room, or in a peripheral vascular lab.

During the exam:

- A water-soluble gel is placed on a handheld device called a transducer. This device directs high-frequency sound waves to the artery or veins being tested.
- Blood pressure cuffs may be put around different parts of the body, including the thigh, calf, ankle, and different points along the arm.

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

You will need to remove clothes from the arm or leg being examined.

#### **How the Test will Feel**

Sometimes, the person performing the test will need to press on the vein to make sure it does not have a clot. Some people may feel slight pain from the pressure.

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

This test is done as the first step to look at arteries and veins.

Sometimes, arteriography and venography may be needed later. The test is done to help diagnose:

- Arteriosclerosis of the arms or legs
- Blood clot (deep vein thrombosis)
- Venous insufficiency

The test may also be used to:

- Look at injury to the arteries
- Monitor arterial reconstruction and bypass grafts

#### **Normal Results**

A normal result means the blood vessels show no signs of narrowing, clots, or closure, and the arteries have normal blood flow.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- Blockage in an artery by a blood clot
- Blood clot in a vein (DVT)
- Narrowing or widening of an artery
- Spastic arterial disease (arterial contractions brought on by cold or emotion)
- Venous occlusion (closing of a vein)
- Venous reflux (blood flow going the wrong direction in veins)
- Arterial occlusion from atherosclerosis

This test may also be done to help assess the following conditions:

- Arteriosclerosis of the extremities
- Deep venous thrombosis
- Superficial thrombophlebitis

#### **Risks**

There are no risks from this procedure.

#### **Considerations**

Cigarette smoking may alter the results of this test. Nicotine can cause the arteries in the extremities to constrict.

Quitting smoking lowers the risk for problems with the heart and circulatory system. Most smoking-related deaths are caused by cardiovascular problems, not lung cancer.

#### **Dry mouth**

#### **Definition**

Dry mouth occurs when you don't make enough saliva. This causes your mouth to feel dry and uncomfortable. Dry mouth that is ongoing may be a sign of illness, and can lead to problems with your mouth and teeth.

#### **Alternative Names**

Xerostomia; Dry mouth syndrome; Cotton mouth syndrome; Cotton mouth; Hyposalivation; Oral dryness

#### **Considerations**

Saliva helps you break down and swallow foods and protects teeth from decay. A lack of saliva may cause a sticky, dry feeling in your mouth and throat. The saliva may become thick or stringy. Other symptoms may include:

- Cracked lips
- Dry, rough, or raw tongue
- Loss of taste
- Sore throat
- Burning or tingling sensation in the mouth
- Feeling thirsty
- Difficulty speaking
- Difficulty chewing and swallowing

Too little saliva in your mouth allows acid-producing bacteria to increase. This can lead to:

- Bad breath
- Increase in dental cavities and gum disease
- Increased risk of yeast infection (thrush)
- Mouth sores or infections

#### **Causes**

Dry mouth occurs when salivary glands do not produce enough saliva to keep your mouth wet or they stop making it altogether.

Common causes of dry mouth include:

- Many medicines, both prescription and over-the-counter, such as antihistamines, decongestants, and medicines for conditions including high blood pressure, anxiety, depression, pain, heart disease, asthma or other respiratory conditions, and epilepsy
- Dehydration
- Radiation therapy to the head and neck that can damage the salivary glands
- Chemotherapy that can affect the production of saliva
- Injury to the nerves involved in the production of saliva
- Health problems such as Sjögren syndrome, diabetes, HIV/AIDS, Parkinson disease, cystic fibrosis, or Alzheimer disease
- Removal of salivary glands due to an infection or tumor
- Tobacco use
- Drinking alcohol
- Street drug use, such as smoking marijuana or using methamphetamine (meth)

You can also get dry mouth if you feel stressed or anxious or become dehydrated.

Dry mouth is common in older adults. But aging itself does not cause dry mouth. Older adults tend to have more health conditions and take more medicines, which increases the risk of dry mouth.

#### **Home Care**

Try these tips to soothe dry mouth symptoms:

- Drink plenty of water or fluids to stay hydrated.
- Suck on ice chips, frozen grapes, or sugar-free frozen fruit pops to help keep your mouth moist.
- Chew sugar-free gum or hard candy to stimulate saliva flow.
- Try to breathe through your nose and not your mouth.
- Use a humidifier at night when sleeping.
- Try over-the-counter artificial saliva or mouth sprays or moisturizers.
- Use oral rinses made for dry mouth to help moisten your mouth and maintain oral hygiene.

Making these changes in your diet may help:

- Eat soft, easy-to-chew food.

- Include cool and bland foods. Avoid hot, spicy and acidic foods.
- Eat foods with a high liquid content, such as those with gravy, broth, or a sauce.
- Drink liquids with your meals.
- Dunk your bread or other hard or crunchy food in a liquid before swallowing.
- Cut your food into small pieces to make it easier to chew.
- Eat small meals and eat more often.

Certain things can make dry mouth worse, so it's best to avoid:

- Sugary drinks
- Caffeine from coffee, tea, and soft drinks
- Alcohol and alcohol-based mouth washes
- Acidic foods such as orange or grapefruit juice
- Dry, rough foods that may irritate your tongue or mouth
- Tobacco and tobacco products

To take care of your oral health:

- Floss at least once per day. It is best to floss before brushing.
- Use a fluoride toothpaste and brush your teeth with a soft-bristled toothbrush. This helps prevent damage to tooth enamel and gums.
- Brush after every meal.
- Schedule regular checkups with your dentist. Talk with your dentist about how often to have checkups.

### **When to Contact a Medical Professional**

Contact your health care provider if:

- You have dry mouth that does not go away
- You have trouble swallowing
- You have a burning sensation in your mouth
- You have white patches in your mouth

### **What to Expect at Your Office Visit**

Proper treatment involves finding out the cause of dry mouth.

Your provider will:

- Review your medical history
- Examine your symptoms
- Take a look at the medicines you are taking

Your provider may order:

- Blood tests
- Imaging scans of your salivary gland
- Salivary flow collection test to measure saliva production in your mouth
- Other tests as needed to diagnose the cause

If your medicine is the cause, your provider may change the type or medicine or the dose. Your provider may also prescribe:

- Medicines that promote the secretion of saliva
- Saliva substitutes that replace natural saliva in your mouth

## **Duplex ultrasound**

### **Definition**

A duplex ultrasound is a test to see how blood moves through your arteries and veins.

### **Alternative Names**

Vascular ultrasound; Peripheral vascular ultrasound

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

A duplex ultrasound combines:

- Traditional ultrasound: This uses sound waves that bounce off blood vessels to create pictures.
- Doppler ultrasound: This records sound waves reflecting off moving objects, such as blood, to measure their speed and other aspects of how they flow.

There are different types of duplex ultrasound exams. Some include:

- Arterial and venous duplex ultrasound of the abdomen. This test examines blood vessels and blood flow in the abdominal area.

- Carotid duplex ultrasound looks at the carotid artery in the neck.
- Duplex ultrasound of the extremities looks at the arms or legs.
- Renal duplex ultrasound examines the kidneys and their blood vessels.

You may need to wear a medical gown. You will lie down on a table, and the ultrasound technician will spread a gel over the area being tested. The gel helps the sound waves get into your tissues.

A wand, called a transducer, is moved over the area being tested. This wand sends out the sound waves. A computer measures how the sound waves reflect back, and changes the sound waves into pictures. The Doppler creates a "swishing" sound, which is the sound of your blood moving through the arteries and veins.

You need to stay still during the exam. You may be asked to lie in different body positions, or to take a deep breath and hold it.

Sometimes during a duplex ultrasound of the legs, the health care provider may calculate an ankle-brachial index (ABI). You will need to wear blood pressure cuffs on your arms and legs for this test.

The ABI number is obtained by dividing the blood pressure in the ankle by the blood pressure in the arm. A value of 0.9 or greater is normal.

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

Usually, there is no preparation for this test.

If you are having an ultrasound of your stomach area, you may be asked not to eat or drink after midnight. Tell the person doing the ultrasound exam if you are taking any medicines, such as blood thinners. These might affect the results of the test.

### **How the Test will Feel**

You may feel some pressure as the wand is moved over the body, but there is no discomfort most of the time.

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

A duplex ultrasound can show how blood flows to many parts of the body. It can also tell the width of a blood vessel and reveal any blockages. This test is a less invasive option than arteriography and venography.

A duplex ultrasound can help diagnose the following conditions:

- Abdominal aneurysm
- Arterial occlusion
- Blood clot
- Carotid occlusive disease (See: Carotid duplex)
- Renal vascular disease
- Varicose veins
- Venous insufficiency

A renal duplex ultrasound can also be used after transplant surgery. This shows how well a new kidney is working.

### **Normal Results**

A normal result is normal blood flow through the veins and arteries. There is normal blood pressure and no sign of a narrowing or blockage of a blood vessel.

### **What Abnormal Results Mean**

An abnormal result depends on the specific area being examined. An abnormal result may be due to a blood clot or plaque buildup in a blood vessel.

### **Risks**

There are no risks.

### **Considerations**

Smoking may change the results of an ultrasound of the arms and legs. This happens because nicotine can cause the arteries to shrink (constrict).

### **D-xylose absorption**

#### **Definition**

D-xylose absorption is a laboratory test to check how well the intestines absorb a simple sugar (D-xylose). The test helps detect if nutrients are being properly absorbed.

#### **Alternative Names**



Xylose tolerance test; Diarrhea - xylose; Malnutrition - xylose; Sprue - xylose; Celiac - xylose

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

The test requires a blood and urine sample. These tests include:

- Clean catch urine specimen
- Venipuncture (blood draw)

There are several ways to perform this test. A typical procedure is described below, but make sure you follow the specific instructions you are given.

You will be asked to drink 8 ounces (240 ml) of water that contains 25 grams of a sugar called d-xylose. The amount of d-xylose that comes out in your urine over the next 5 hours will be measured. You may have a blood sample collected at 1 and 3 hours after drinking the liquid. In some cases, the sample may be collected every hour. The amount of urine you produce over a 5-hour period is also checked. Your health care provider will tell you how to collect all of the urine during a 5-hour period.

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

Do not eat or drink anything (even water) for 8 to 12 hours before the test. Your provider will ask you to rest during the test. A failure to restrict activity may affect test results.

Your provider may tell you to stop taking certain medicines that can affect test results. Medicines that can affect test results include aspirin, atropine, indomethacin, isocarboxazid, and phenelzine.

DO NOT stop taking any medicine without first talking to your provider.

### **How the Test will Feel**

When the needle is inserted to draw blood, you may feel moderate pain, or only a prick or stinging sensation. Afterward, there may be some throbbing.

Urine is collected as part of normal urination with no discomfort.

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

Your provider may order this test if you have:

- Persistent diarrhea
- Signs of malnutrition
- Unexplained weight loss

This test is primarily used to check if nutrient absorption problems are due to a disease of the intestines. It is performed much less often than in the past.

### **Normal Results**

A normal result depends on how much D-xylose is given. In most cases, the test results are either positive or negative. A positive result means that D-xylose is found in the blood or urine and is therefore being absorbed by the intestines.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Lower than normal values may be seen in:

- Celiac disease (sprue)
- Crohn disease
- Giardia lamblia infestation
- Hookworm infestation
- Lymphatic obstruction
- Radiation enteropathy
- Small intestinal bacterial overgrowth
- Viral gastroenteritis
- Whipple disease

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Fainting or feeling lightheaded
- Multiple punctures to locate veins

- Hematoma (blood buildup under the skin)
- Excessive bleeding
- Infection (a slight risk any time the skin is broken)

### **Considerations**

Multiple tests may be necessary to determine the reason for malabsorption.

### **Ear drainage culture**

#### **Definition**

An ear drainage culture is a lab test. This test checks for germs that can cause infection. The sample taken for this test can contain fluid, pus, wax, or blood from the ear.

#### **Alternative Names**

Culture - ear drainage

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

A sample of ear drainage is needed. Your health care provider will use a cotton swab to collect the sample from inside the outer ear canal. In some cases, a sample is collected from the middle ear during ear surgery.

The sample is sent to a lab and placed on a special dish (culture media).

The lab team checks the dish every day to see if bacteria, fungi, or viruses have grown. More tests may be done to look for specific germs and determine the best treatment.

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

You do not need to prepare for this test.

#### **How the Test will Feel**

Using a cotton swab to take a sample of drainage from the outer ear is not painful. However, ear pain may be present if the ear is infected.

Ear surgery is done using general anesthesia. You will be asleep and feel no pain.

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

The test may be done if you or your child has:

- An ear infection that is not getting better with treatment
- An infection of the outer ear (otitis externa)
- An ear infection with a ruptured eardrum and draining fluid

It may also be done as a routine part of myringotomy.

Note: Ear infections are diagnosed based on symptoms rather than using a culture.

#### **Normal Results**

The test is normal if there is no growth on the culture.

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may be a sign of an infection. The infection can be caused by bacteria, virus, or fungus.

The test results may show which organism is causing the infection. It will help your provider decide on the right treatment.

#### **Risks**

No risks are involved with swabbing the ear canal. Ear surgery may involve some risks.

### **Ear examination**

#### **Definition**

An ear exam is performed when a health care provider looks inside your ear using an instrument called an otoscope.

#### **Alternative Names**

Otoscopy

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

The provider may dim the lights in the room.

A young child will be asked to lie on their back with the head turned to the side, or the child's head may rest against an adult's chest.

Older children and adults may sit with the head tilted toward the shoulder opposite the ear being examined.

The provider will gently pull up, back, or forward on the ear to straighten the ear canal. Then, the tip of the otoscope will be placed gently into your ear. A light beam shines through the otoscope into the ear canal. The provider will carefully move the scope in different directions to see the inside of the ear and eardrum. Sometimes, this view may be blocked by earwax. An ear specialist may use a binocular microscope to get a magnified look at the ear.

The otoscope may have a plastic bulb on it, which delivers a tiny puff of air into the outer ear canal when pressed. This is done to see how the eardrum moves. Decreased movement can mean that there is fluid in the middle ear.

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

No preparation is needed for this test.

#### **How the Test will Feel**

If there is an ear infection, there may be some discomfort or pain. The provider will stop the test if the pain worsens.

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

An ear exam may be done if you have an earache, ear infection, hearing loss, or other ear symptoms.

Examining the ear also helps the provider see if treatment for an ear problem is working.

#### **Normal Results**

The ear canal differs in size, shape, and color from person to person. Normally, the canal is skin-colored and has small hairs. Yellowish-brown earwax may be present. The eardrum is a light-gray color or a shiny pearly-white. Light should reflect off the eardrum surface.

#### **What Abnormal Results Mean**

Ear infections are a common problem, especially with small children. A dull or absent light reflex from the eardrum may be a sign of a middle ear infection or fluid. The eardrum may be red and bulging if there is an infection. Amber liquid or bubbles behind the eardrum are often seen if fluid collects in the middle ear.

Abnormal results may also be due to an external ear infection. You might feel pain when the outer ear is pulled or wiggled. The ear canal may be red, tender, swollen, or filled with yellowish-green pus.

The test may also be done for the following conditions:

- Cholesteatoma
- External ear infection - chronic
- Head injury
- Ruptured or perforated eardrum

#### **Risks**

An infection can be spread from one ear to the other if the instrument used to look inside the ear has not been cleaned well.

#### **Considerations**

Not all ear problems can be detected by looking through an otoscope. Other ear and hearing tests may be needed.

Otosopes sold for at-home use are lower quality than the ones used at the provider's office.

Parents may not be able to recognize some of the subtle signs of an ear problem. See a provider if there are symptoms of:

- Severe ear pain
- Hearing loss
- Dizziness
- Fever
- Ringing in the ears
- Ear discharge or bleeding

#### **Echocardiogram**

##### **Definition**

An echocardiogram is a test that uses sound waves to create pictures of the heart. The picture and information it produces is more detailed than a standard x-ray image. An echocardiogram does not expose you to radiation.

##### **Alternative Names**

Transthoracic echocardiogram (TTE); Echocardiogram - transthoracic; Doppler ultrasound of the heart; Surface echo

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

#### **TRANSTHORACIC ECHOCARDIOGRAM (TTE)**

TTE is the type of echocardiogram that most people will have.

- A trained sonographer performs the test. A heart doctor (cardiologist) interprets the results.
- An instrument called a transducer is placed on various locations on your chest and upper abdomen and directed toward the heart. This device releases high-frequency sound waves.
- The transducer picks up the echoes of sound waves and transmits them as electrical impulses. The echocardiography machine converts these impulses into moving pictures of the heart. Still pictures are also taken.
- Pictures can be two-dimensional or three-dimensional. The type of picture will depend on the part of the heart being evaluated and the type of machine.
- A Doppler echocardiogram evaluates the motion of blood through the heart.

An echocardiogram shows the heart while it is beating. It also shows the heart valves and other structures.

In some cases, your lungs, ribs, or body tissue may prevent the sound waves and echoes from providing a clear picture of heart function. If this is a problem, the health care provider may inject a small amount of liquid (contrast) through an IV to better see the inside of the heart.

Rarely, more invasive testing using special echocardiography probes may be needed.

#### **TRANSESOPHAGEAL ECHOCARDIOGRAM (TEE)**

For a TEE, the back of your throat is numbed and a long flexible but firm tube (called a "probe") which has a small ultrasound transducer at the end is inserted down your throat.

A heart doctor with special training will guide the scope down the esophagus and into the stomach.

This method is used to get clearer echocardiographic images of your heart. The provider may use this test to look for signs of infection (endocarditis) blood clots (thrombi), or other abnormal structures or connections.

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

No special steps are needed before a TTE test. If you are having a TEE, you will not be able to eat or drink for several hours before the test.

### **How the Test will Feel**

During the test:

- You will need to take off your clothes from the waist up and lie on an exam table on your back.
- Electrodes will be placed on your chest to monitor your heart beat.
- A small amount of gel is spread on your chest and the transducer will be moved over your skin. You will feel a slight pressure on your chest from the transducer.
- You may be asked to breathe in a certain way or to roll over onto your left side. Sometimes, a special bed is used to help you stay in the proper position.
- If you are having a TEE, you will receive some sedating (relaxing) medicines prior to having the probe inserted and a numbing fluid may be sprayed in the back of your throat.

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

This test is done to evaluate the valves and chambers of the heart from the outside of your body.

The echocardiogram can help detect:

- Abnormal heart valves
- Congenital heart disease (abnormalities present at birth)
- Damage to the heart muscle from a heart attack
- Heart murmurs
- Inflammation (pericarditis) or fluid in the sac around the heart (pericardial effusion)
- Infection on or around the heart valves (infectious endocarditis)
- Pulmonary hypertension
- Ability of the heart to pump (for people with heart failure)
- Source of a blood clot after a stroke or TIA

Your provider may recommend a TEE if:

- The regular (or TTE) is unclear. Unclear results may be due to the shape of your chest, lung disease, or excess body fat.
- An area of the heart needs to be looked at in more detail.

### **Normal Results**

A normal echocardiogram reveals normal heart valves and chambers and normal heart wall movement.

### **What Abnormal Results Mean**

An abnormal echocardiogram can mean many things. Some abnormalities are very minor and do not pose major risks. Other abnormalities are signs of serious heart disease. You will need more tests by a specialist in this case. It is very important to talk about the results of your echocardiogram with your provider.

### **Risks**

There are no known risks from an external TTE test.

TEE is an invasive procedure. There is some risk associated with the test. These may include:

- Reaction to the sedating medicines.
- Damage to the esophagus. This is more common if you already have a problem with your esophagus.

Talk with your provider about the risks associated with this test.

### **Considerations**

Abnormal results may indicate:

- Heart valve disease
- Cardiomyopathy
- Pericardial effusion
- Other heart abnormalities

This test is used to evaluate and monitor many different heart conditions.

## **Echocardiogram - children**

### **Definition**

An echocardiogram is a test that uses sound waves to create pictures of the heart. It is used with children to help diagnose defects of the heart that are present at birth (congenital). The picture is more detailed than a regular x-ray image. An echocardiogram also does not expose children to radiation.

### **Alternative Names**

Transthoracic echocardiogram (TTE) - children; Echocardiogram - transthoracic - children; Doppler ultrasound of the heart - children; Surface echo - children

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

Your child's health care provider may do the test in a clinic, in a hospital, or at an outpatient center. Echocardiography in children is done either with the child lying down or lying in their parent's lap. This approach can help comfort them and keep them still.

For each of these tests, a trained sonographer performs the test. A cardiologist interprets the results.

### **TRANSTHORACIC ECHOCARDIOGRAM (TTE)**

TTE is the type of echocardiogram that most children will have.

- The sonographer puts gel on the child's ribs near the breastbone in the area around the heart. A hand-held instrument, called a transducer, is pressed on the gel on the child's chest and directed toward the heart. This device releases high-frequency sound waves.
- The transducer picks up the echo of sound waves coming back from the heart and blood vessels.
- The echocardiography machine converts these impulses into moving pictures of the heart. Still pictures are also taken.
- Pictures can be two-dimensional or three-dimensional.
- The entire procedure lasts for about 20 to 40 minutes.

The test allows the provider to see the heart beating. It also shows the heart valves and other structures.

Sometimes, the lungs, ribs, or body tissues may prevent the sound waves from producing a clear picture of the heart. In this case, the sonographer may inject a small amount of liquid (contrast dye) through an IV to better see the inside of the heart.

### **TRANSESOPHAGEAL ECHOCARDIOGRAM (TEE)**

TEE is another type of echocardiogram that children can have. The test is done with the child lying under sedation.

- The sonographer will numb the back of your child's throat and insert a small tube into the child's food pipe (esophagus). The end of the tube contains a device to send out sound waves.
- The sound waves reflect off the structures in the heart and are displayed on a screen as images of the heart and blood vessels.
- Because the esophagus is right behind the heart, this method is used to get clearer pictures of the heart.

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

You can take these steps to prepare your child before the procedure:

- Do not allow your child to eat or drink anything prior to having a TEE.
- Do not use any cream or oil on your child before the exam.
- Explain the test in detail to older children so they understand that they should remain still during the test.
- Younger children less than 4 years of age may need medicine (sedation) to help them stay still for clearer pictures.
- Give children older than 4 a toy to hold or have them watch videos to help them stay calm and still during the test.

### **How the Test will Feel**

- Your child will need to remove any clothes from the waist up and lie flat on the exam table.
- Electrodes will be placed on your child's chest to monitor the heart beat.
- A gel is applied on the child's chest. It may be cold. A transducer head will be pressed over the gel. The child might feel pressure due to the transducer.
- Younger children may feel restless during the test. Parents should try to keep the child calm during the test.

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

This test is done to examine the function, heart valves, major blood vessels, and chambers of a child's heart from outside of the body.

- Your child may have signs or symptoms of heart problems.
- These may include shortness of breath, poor growth, leg swelling, heart murmur, bluish color around the lips when crying, chest pains, unexplained fever, or germs growing in a blood culture test.

Your child may have an increased risk for heart problems due to an abnormal genetic test or other birth defects that are present.

The provider may recommend a TEE if:

- The TTE is unclear. Unclear results may be due to the shape of the child's chest, lung disease, or excess body fat.
- An area of the heart needs to be looked at in more detail.

### **Normal Results**

A normal result means that there are no defects in the heart valves or chambers and there is normal heart wall movement.

### **What Abnormal Results Mean**

An abnormal echocardiogram in a child can mean many things. Some abnormal findings are very minor and do not pose major risks. Others are signs of serious heart disease. In this case, the child will need more tests by a specialist. It is very important to talk about the results of the echocardiogram with your child's provider.

The echocardiogram can help detect:

- Abnormal heart valves
- Abnormal heart rhythms



- Birth defects of the heart
- Inflammation (pericarditis) or fluid in the sac around the heart (pericardial effusion)
- Infection on or around the heart valves
- High blood pressure in the blood vessels to the lungs
- How well the heart can pump
- Source of a blood clot after a stroke or TIA

### **Risks**

TTE in children does not have any known risk.

TEE is an invasive procedure. There may be some risks with this test. Talk with your provider about risks associated with this test.

### **EEG**

#### **Definition**

An electroencephalogram (EEG) is a test to measure the electrical activity of the brain.

#### **Alternative Names**

Electroencephalogram; Brain wave test; Epilepsy - EEG; Seizure - EEG

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

The test is done by an electroencephalogram technologist in your doctor's office or at a hospital or laboratory.

The test is done in the following way:

- You lie on your back on a bed or in a reclining chair.
- Flat metal disks called electrodes are placed all over your scalp. The disks are held in place with a sticky paste. The electrodes are connected by wires to a recording machine. The machine changes the electrical signals into patterns that can be seen on a monitor or drawn on paper. These patterns look like wavy lines.
- You need to lie still during the test with your eyes closed. This is because movement can change the results. You may be asked to do certain things during the test, such as breathe fast and deeply for several minutes or look at a bright flashing light.
- You may be asked to sleep during the test.

If your doctor needs to monitor your brain activity for a longer period, an ambulatory EEG will be ordered. In addition to the electrodes, you will wear or carry a special recorder for up to 3 days. You will be able to go about your normal routine as the EEG is being recorded. Or, your doctor may ask you to stay overnight in a special EEG monitoring unit where your brain activity will be monitored continuously.

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

Wash your hair the night before the test. DO NOT use conditioner, oils, sprays, or gel on your hair. If you have a hair weave, ask your health care provider for special instructions.

Your provider may want you to stop taking certain medicines before the test. DO NOT change or stop taking any medicines without first talking to your provider. Bring a list of your medicines with you.

Avoid all food and drinks containing caffeine for 8 hours before the test.

You may need to sleep during the test. If so, you may be asked to reduce your sleep time the night before. If you are asked to sleep as little as possible before the test, DO NOT eat or drink any caffeine, energy drinks, or other products that help you stay awake.

Follow any other specific instructions you are given.

#### **How the Test will Feel**

The electrodes may feel sticky and strange on your scalp, but should not cause any other discomfort. You should not feel any discomfort during the test.

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

Brain cells communicate with each other by producing tiny electrical signals, called impulses. An EEG measures this activity. It can be used to diagnose or monitor the following health conditions:

- Seizures and epilepsy
- Abnormal changes in body chemistry that affect the brain
- Brain diseases, such as Alzheimer disease
- Confusion
- Fainting spells or periods of memory loss that cannot be explained otherwise

- Head injuries
- Infections
- Tumors

EEG is also used to:

- Evaluate problems with sleep (sleep disorders)
- Monitor the brain during brain surgery

An EEG may be done to show that the brain has no activity, in the case of someone who is in a deep coma. It can be helpful when trying to decide if a person is brain dead.

EEG cannot be used to measure intelligence.

### **Normal Results**

Brain electrical activity has a certain number of waves per second (frequencies) that are normal for different levels of alertness. For example, brain waves are faster when you are awake and slower in certain stages of sleep.

There are also normal patterns to these waves.

Note: A normal EEG does not mean that a seizure did not occur.

### **What Abnormal Results Mean**

Abnormal results on an EEG test may be due to:

- Abnormal bleeding (hemorrhage)
- An abnormal structure in the brain (such as a brain tumor)
- Tissue death due to a blockage in blood flow (cerebral infarction)
- Drug or alcohol abuse
- Head injury
- Migraines (in some cases)
- Seizure disorder (such as epilepsy)
- Sleep disorder (such as narcolepsy)
- Swelling of the brain (edema)

### **Risks**

An EEG test is very safe. The flashing lights or fast breathing (hyperventilation) required during the test may trigger seizures in those with seizure disorders. The provider performing the EEG is trained to take care of you if this happens.

## **EGD-esophagogastroduodenoscopy**

### **Definition**

Esophagogastroduodenoscopy (EGD) is a test to examine the lining of the esophagus, stomach, and first part of the small intestine (the duodenum).

### **Alternative Names**

Esophagogastroduodenoscopy; Upper endoscopy; Gastroscopy

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

EGD is done in a hospital or medical center. The procedure uses an endoscope. This is a flexible tube with a light and camera at the end.

The procedure is done as follows:

- During the procedure, your breathing, heart rate, blood pressure, and oxygen level are checked. Wires are attached to certain areas of your body and then to machines that monitor these vital signs.
- You receive medicine into a vein to help you relax. You should feel no pain and not remember the procedure.
- A local anesthetic may be sprayed into your mouth to prevent you from coughing or gagging when the scope is inserted.
- A mouth guard is used to protect your teeth and the scope. Dentures must be removed before the procedure begins.
- You then lie on your left side.
- The scope is inserted through the esophagus (food pipe) to the stomach and duodenum. The duodenum is the first part of the small intestine.
- Air is put through the scope to make it easier for the doctor to see.

- The lining of the esophagus, stomach, and upper duodenum is examined. Biopsies can be taken through the scope. Biopsies are tissue samples that are looked at under the microscope.
- Different treatments may be done, such as stretching or widening a narrowed area of the esophagus.

After the test is finished, you will not be able to have food and liquid until your gag reflex returns (so you do not choke).

The test lasts about 5 to 20 minutes.

Follow any instructions you're given for recovering at home.

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

You will not be able to eat anything for 6 to 12 hours before the test. Follow instructions about stopping aspirin and other blood-thinning medicines before the test.

### **How the Test will Feel**

The anesthetic spray makes it hard to swallow. This wears off shortly after the procedure. The scope may make you gag.

You may feel gas and the movement of the scope in your abdomen. You will not be able to feel the biopsy. Because of sedation, you may not feel any discomfort and have no memory of the test.

You may feel bloated from the air that was put into your body. This feeling soon wears off.

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

EGD may be done if you have symptoms that are new, cannot be explained, or are not responding to treatment, such as:

- Black or tarry stools or vomiting blood
- Bringing food back up (regurgitation)
- Feeling full sooner than normal or after eating less than usual
- Feeling like food is stuck behind the breastbone
- Heartburn
- Low blood count (anemia) that cannot be explained
- Pain or discomfort in the upper abdomen
- Swallowing problems or pain with swallowing
- Weight loss that cannot be explained
- Nausea or vomiting that does not go away

Your doctor may also order this test if you:

- Have cirrhosis of the liver, to look for swollen veins (called varices) in the walls of the lower part of the esophagus, which may begin to bleed
- Have Crohn disease
- Need more follow-up or treatment for a condition that has been diagnosed

The test may also be used to take a piece of tissue for biopsy.

### **Normal Results**

The esophagus, stomach, and duodenum should be smooth and of normal color. There should be no bleeding, growths, ulcers, or inflammation.

### **What Abnormal Results Mean**

An abnormal EGD may be the result of:

- Celiac disease (damage to the lining of the small intestine from a reaction to eating gluten)
- Esophageal varices (swollen veins in the lining of the esophagus caused by liver cirrhosis)
- Esophagitis (lining of the esophagus becomes inflamed or swollen)
- Gastritis (lining of the stomach and duodenum is inflamed or swollen)
- Gastroesophageal reflux disease (a condition in which food or liquid from the stomach leaks backwards into the esophagus)
- Hiatal hernia (a condition in which part of the stomach sticks up into the chest through an opening in the diaphragm)
- Mallory-Weiss syndrome (tear in the esophagus)
- Narrowing of the esophagus, such as from a condition called esophageal ring
- Tumors or cancer in the esophagus, stomach, or duodenum (first part of small intestine)
- Ulcers, gastric (stomach) or duodenal (small intestine)

### **Risks**

There is a small chance of a hole (perforation) in the stomach, duodenum, or esophagus from the scope moving through these areas. There is also a small risk of bleeding at the biopsy site. You could have a reaction to the medicine used during the procedure, which could cause:

- Apnea (not breathing)
- Difficulty breathing (respiratory depression)
- Excessive sweating
- Low blood pressure (hypotension)
- Slow heartbeat (bradycardia)
- Spasm of the larynx (laryngospasm)

## **Electrocardiogram**

### **Definition**

An electrocardiogram (ECG) is a test that records the electrical activity of the heart.

### **Alternative Names**

ECG; EKG

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

You will be asked to lie down. The health care provider will clean several areas on your arms, legs, and chest, and then will attach small patches called electrodes to those areas. It may be necessary to shave or clip some hair so the patches stick to the skin. The number of patches used may vary.

The patches are connected by wires to a machine that turns the heart's electrical signals into wavy lines, which are often printed on paper. The doctor reviews the test results.

You will need to remain still during the procedure. The provider may also ask you to hold your breath for a few seconds as the test is being done.

It is important to be relaxed and warm during an ECG recording because any movement, including shivering, can alter the results.

Sometimes this test is done while you are exercising or under light stress to look for changes in the heart. This type of ECG is often called a stress test.

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

Make sure your provider knows about all the medicines you are taking. Some drugs can interfere with test results.

DO NOT exercise or drink cold water immediately before an ECG because these actions may cause false results.

### **How the Test will Feel**

An ECG is painless. No electricity is sent through the body. The electrodes may feel cold when first applied. In rare cases, some people may develop a rash or irritation where the patches were placed.

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

An ECG is used to measure:

- Any damage to the heart
- How fast your heart is beating and whether it is beating normally
- The effects of drugs or devices used to control the heart (such as a pacemaker)
- The size and position of your heart chambers

An ECG is often the first test done to determine whether a person has heart disease. Your provider may order this test if:

- You have chest pain or palpitations
- You are scheduled for surgery
- You have had heart problems in the past
- You have a strong history of heart disease in the family

### **Normal Results**

Normal test results most often include:

- Heart rate: 60 to 100 beats per minute
- Heart rhythm: Consistent and even

### **What Abnormal Results Mean**

Abnormal ECG results may be a sign of:

- Damage or changes to the heart muscle

- Changes in the amount of the electrolytes (such as potassium and calcium) in the blood
- Congenital heart defect
- Enlargement of the heart
- Fluid or swelling in the sac around the heart
- Inflammation of the heart (myocarditis)
- Past or current heart attack
- Poor blood supply to the heart arteries
- Abnormal heart rhythms (arrhythmias)

Some heart problems that can lead to changes on an ECG test include:

- Atrial fibrillation/flutter
- Heart attack
- Heart failure
- Multifocal atrial tachycardia
- Paroxysmal supraventricular tachycardia
- Sick sinus syndrome
- Wolff-Parkinson-White syndrome

### **Risks**

There are no risks.

### **Considerations**

The accuracy of the ECG depends on the condition being tested. A heart problem may not always show up on the ECG. Some heart conditions never produce any specific ECG changes.

### **Electrolytes - urine**

#### **Definition**

The electrolytes - urine test measures specific chemicals called electrolytes in urine. It most often measures the levels of calcium, chloride, potassium, or sodium.

Related topics include:

- Calcium - urine
- Chloride - urine
- Potassium - urine

### **Electromyography**

- Sodium - urine

#### **Definition**

Electromyography (EMG) is a test that checks the health of the muscles and the nerves that control the muscles.

#### **Alternative Names**

EMG; Myogram; Electromyogram

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

The health care provider inserts a very thin needle electrode through the skin into the muscle. The electrode on the needle picks up the electrical activity given off by your muscles. This activity appears on a nearby monitor and may be heard through a speaker.

After placement of the electrodes, you may be asked to contract the muscle. For example, by bending your arm. The electrical activity seen on the monitor provides information about your muscle's ability to respond when the nerves to your muscles are stimulated.

A nerve conduction velocity test is almost always performed during the same visit as an EMG. The velocity test is done to see how fast electrical signals move through a nerve.

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

No special preparation is usually necessary. Avoid using any creams or lotions on the day of the test.

Body temperature can affect the results of this test. If it is extremely cold outside, you may be told to wait in a warm room for a while before the test is performed.

If you are taking blood thinners or anticoagulants, inform the provider performing the test before it is done.

#### **How the Test will Feel**

You may feel some pain or discomfort when the needles are inserted. But most people are able to complete the test without problems.

Afterward, the muscle may feel tender or bruised for a few days.

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

EMG is most often used when a person has symptoms of weakness, pain, or abnormal sensation. It can help tell the difference between muscle weakness caused by the injury of a nerve attached to a muscle, and weakness due to nervous system disorders, such as muscle diseases.

### **Normal Results**

There is normally very little electrical activity in a muscle while at rest. Inserting the needles can cause some electrical activity, but once the muscles quiet down, there should be little electrical activity detected.

When you flex a muscle, activity begins to appear. As you contract your muscle more, the electrical activity increases and a pattern can be seen. This pattern helps your doctor determine if the muscle is responding as it should.

### **What Abnormal Results Mean**

An EMG can detect problems with your muscles during rest or activity. Disorders or conditions that cause abnormal results include the following:

- Alcoholic neuropathy (damage to nerves from drinking too much alcohol)
- Amyotrophic lateral sclerosis (ALS; disease of the nerve cells in the brain and spinal cord that control muscle movement)
- Axillary nerve dysfunction (damage of the nerve that controls shoulder movement and sensation)
- Becker muscular dystrophy (muscle weakness of the legs and pelvis)
- Brachial plexopathy (problem affecting the set of nerves that leave the neck and enter the arm)
- Carpal tunnel syndrome (problem affecting the median nerve in the wrist and hand)
- Cubital tunnel syndrome (problem affecting the ulnar nerve in the elbow)
- Cervical spondylosis (neck pain from wear on the disks and bones of the neck)
- Common peroneal nerve dysfunction (damage of the peroneal nerve leading to loss of movement or sensation in the foot and leg)
- Denervation (reduced nerve stimulation of a muscle)
- Dermatomyositis (muscle disease that involves inflammation and a skin rash)
- Distal median nerve dysfunction (problem affecting the median nerve in the arm)
- Duchenne muscular dystrophy (inherited disease that involves muscle weakness)
- Facioscapulohumeral muscular dystrophy (Landouzy-Dejerine; disease of muscle weakness and loss of muscle tissue)
- Familial periodic paralysis (disorder that causes muscle weakness and sometimes a lower than normal level of potassium in the blood)
- Femoral nerve dysfunction (loss of movement or sensation in parts of the legs due to damage to the femoral nerve)
- Friedreich ataxia (inherited disease that affects areas in the brain and spinal cord that control coordination, muscle movement, and other functions)
- Guillain-Barré syndrome (autoimmune disorder of the nerves that leads to muscle weakness or paralysis)
- Lambert-Eaton syndrome (autoimmune disorder of the nerves that causes muscle weakness)
- Multiple mononeuropathy (a nervous system disorder that involves damage to at least 2 separate nerve areas)
- Mononeuropathy (damage to a single nerve that results in loss of movement, sensation, or other function of that nerve)
- Myopathy (muscle degeneration caused by a number of disorders, including muscular dystrophy)
- Myasthenia gravis (autoimmune disorder of the nerves that causes weakness of the voluntary muscles)
- Peripheral neuropathy (damage of nerves away from the brain and spinal cord)
- Polymyositis (muscle weakness, swelling, tenderness, and tissue damage of the skeletal muscles)



- Radial nerve dysfunction (damage of the radial nerve causing loss of movement or sensation in the back of the arm or hand)
- Sciatic nerve dysfunction (injury to or pressure on the sciatic nerve that causes weakness, numbness, or tingling in the leg)
- Sensorimotor polyneuropathy (condition that causes a decreased ability to move or feel because of nerve damage)
- Shy-Drager syndrome (nervous system disease that causes bodywide symptoms)
- Thyrotoxic periodic paralysis (muscle weakness from high levels of thyroid hormone)
- Tibial nerve dysfunction (damage of the tibial nerve causing loss of movement or sensation in the foot)

### **Risks**

Risks of this test include:

- Bleeding (minimal)
- Infection at the electrode sites (rare)

### **Electronystagmography**

#### **Definition**

Electronystagmography is a test that looks at eye movements to see how well two nerves in the brain are working. These nerves are:

- Vestibular nerve (eighth cranial nerve), which runs from the brain to the ears
- Oculomotor nerve, which runs from the brain to the eyes

#### **Alternative Names**

ENG

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

Patches called electrodes are placed above, below, and on each side of your eyes. They may be sticky patches or attached to a headband. Another patch is attached to the forehead.

The health care provider will spray cold water or air into each ear canal at separate times. The patches record eye movements that occur when the inner ear and nearby nerves are stimulated by the water or air. When cold water enters the ear, you should have rapid, side-to-side eye movements called nystagmus.

Next, warm water or air is placed into the ear. The eyes should now move rapidly toward the warm water then slowly away.

You may also be asked to use your eyes to track objects, such as flashing lights or moving lines.

The test takes about 90 minutes.

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

Most of the time, you do not need to take special steps before this test.

- Your provider will tell you if you need to stop taking any medicines before you have this test.
- DO NOT stop or change your medicines without talking to your provider first.

#### **How the Test will Feel**

You may feel discomfort due to cold water in the ear. During the test, you may have:

- Nausea or vomiting
- Brief dizziness (vertigo)

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

The test is used to determine whether a balance or nerve disorder is the cause of dizziness or vertigo.

You may have this test if you have:

- Dizziness or vertigo
- Hearing loss
- Possible damage to the inner ear from certain medicines

#### **Normal Results**

Certain eye movements should occur after the warm or cold water or air is placed into your ears.

Note: Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may be a sign of damage to the nerve of the inner ear or other parts of the brain that control eye movements.

Any disease or injury that damages the acoustic nerve can cause vertigo. This may include:

- Blood vessel disorders with bleeding (hemorrhage), clots, or atherosclerosis of the blood supply of the ear
- Cholesteatoma and other ear tumors
- Congenital disorders
- Injury
- Medicines that are toxic to the ear nerves, including aminoglycoside antibiotics, some antimalarial drugs, loop diuretics, and salicylates
- Multiple sclerosis
- Movement disorders such as progressive supranuclear palsy
- Rubella
- Some poisons

Additional conditions under which the test may be performed:

- Acoustic neuroma
- Benign positional vertigo
- Labyrinthitis
- Meniere disease

### **Risks**

Rarely, too much water pressure inside the ear can injure your ear drum if there has been previous damage. The water part of this test should not be done if your eardrum has been perforated recently.

### **Considerations**

Electronystagmography is very useful because it can record movements behind closed eyelids or with the head in many positions.

### **Electroretinography**

#### **Definition**

Electroretinography is a test to measure the electrical response of the eye's light-sensitive cells, called rods and cones. These cells are part of the retina (the back part of the eye).

#### **Alternative Names**

ERG; Electrophysiologic testing

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

While you are in a sitting position, the health care provider places numbing drops into your eyes, so you will not have any discomfort during the test. Your eyes are held open with a small device called a speculum. An electrical sensor (electrode) is placed on each eye.

The electrode measures the electrical activity of the retina in response to light. A light flashes, and the electrical response travels from the electrode to a TV-like screen, where it can be viewed and recorded. The normal response pattern has waves called A and B.

The provider will take the readings in normal room light and then again in the dark, after allowing 20 minutes for your eyes to adjust.

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

No special preparation is necessary for this test.

#### **How the Test will Feel**

The probes that rest on your eye may feel a little scratchy. The test takes about 1 hour to perform.

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

This test is done to detect disorders of the retina. It is also useful for determining if retinal surgery is recommended.

#### **Normal Results**

Normal test results will show a normal A and B pattern in response to each flash.

#### **What Abnormal Results Mean**

The following conditions may cause abnormal results:

- Arteriosclerosis with damage to the retina
- Congenital night blindness
- Congenital retinoschisis (splitting of the retinal layers)

- Giant cell arteritis
- Medicines (chloroquine, hydroxychloroquine)
- Mucopolysaccharidosis
- Retinal detachment
- Rod-cone dystrophy (retinitis pigmentosa)
- Trauma
- Vitamin A deficiency

### **Risks**

The cornea may get a temporary scratch on the surface from the electrode. Otherwise, there are no risks with this procedure.

### **Considerations**

You should not rub your eyes for an hour after the test, as this could injure the cornea. Your provider will talk to you about the results of the test and what they mean for you.

### **ELISA blood test**

#### **Definition**

ELISA stands for enzyme-linked immunoassay. It is a commonly used laboratory test to detect antibodies in the blood. An antibody is a protein produced by the body's immune system when it detects harmful substances, called antigens.

#### **Alternative Names**

Enzyme-linked immunoassay; EIA

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

A blood sample is needed. Most of the time, blood is drawn from a vein located on the inside of the elbow or the back of the hand.

The sample is sent to a laboratory where the targeted antibody or antigen is linked to a specific enzyme. If the target substance is in the sample, the test solution turns a different color.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is often used to see if you have been exposed to viruses or other substances that cause infection. It is also used to screen for current or past infections.

#### **Normal Results**

Normal values depend on the type of substance being identified. Some laboratories use different measurements or test different samples. Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal values depend on the type of substance being identified. In some people, a positive result may be normal.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Endocervical culture**

#### **Definition**

Endocervical culture is a laboratory test that helps identify infection in the female genital tract.

#### **Alternative Names**

Vaginal culture; Female genital tract culture; Culture - cervix

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

During a vaginal examination, the health care provider uses a swab to take samples of mucus and cells from the endocervix. This is the area around the opening of the uterus. The samples are sent to a lab. There, they are placed in a special dish (culture). They are then watched to see if bacteria, virus, or fungus grow. Further tests may be done to identify the specific organism and determine the best treatment.

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

In the 2 days before the procedure:

- Do NOT use creams or other medicines in the vagina.
- Do NOT douche. (You should never douche. Douching can cause infection of the vagina or uterus.)
- Empty your bladder and bowel.
- At your provider's office, follow instructions for preparing for the vaginal exam.

### **How the Test will Feel**

You will feel some pressure from the speculum. This is an instrument inserted into the vagina to hold the area open so that the provider can view the cervix and collect the samples. There may be a slight cramping when the swab touches the cervix.

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

The test may be done to determine the cause of vaginitis, pelvic pain, an unusual vaginal discharge, or other signs of infection.

### **Normal Results**

Organisms that are usually present in the vagina are there in the expected amounts.

### **What Abnormal Results Mean**

Abnormal results indicate the presence of an infection in the genital tract or urinary tract in women, such as:

- Genital herpes
- Chronic swelling and irritation of the urethra (urethritis)
- Sexually transmitted infections, such as gonorrhea or chlamydia
- Pelvic inflammatory disease (PID)

### **Risks**

There may be slight bleeding or spotting after the test. This is normal.

### **Endocervical Gram stain**

#### **Definition**

Endocervical Gram stain is a method to detect bacteria on tissue from the cervix. This is done using a special series of stains.

#### **Alternative Names**

Gram stain of cervix; Gram stain of cervical secretions

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

This test requires a sample of secretions from the lining of the cervical canal (the opening to the uterus).

You lie on your back with your feet in stirrups. The health care provider will insert an instrument called a speculum into the vagina. This instrument is used during regular female pelvic exams. It opens the vagina to better view certain pelvic structures.

After the cervix is cleaned, a dry, sterile swab is inserted through the speculum to the cervical canal and gently turned. It may be left in place for a few seconds to absorb as many germs as possible.

The swab is removed and sent to a laboratory, where it will be smeared on a slide. A series of stains called a Gram stain is applied to the sample. A laboratory technician looks at the stained smear under the microscope for the presence of bacteria. The color, size, and shape of the cells help identify the type of bacteria.

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

DO NOT douche for 24 hours before the procedure.

#### **How the Test will Feel**

You may feel minor discomfort during specimen collection. This procedure feels very much like a routine Pap smear.

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

This test is used to detect and identify abnormal bacteria in the cervix area. If you develop signs of an infection or think that you have a sexually transmitted disease (such as gonorrhea), this test can help confirm the diagnosis. It can also identify the germ that is causing the infection.

This test is rarely done because it has been replaced with more accurate ones.

### **Normal Results**

A normal result means no abnormal bacteria are seen in the sample.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Abnormal result may indicate:

- Bacterial vaginosis
- Chlamydia
- Gonorrhea
- Yeast infection

The test may also be performed for gonococcal arthritis, to determine the site of the initial infection.

### **Risks**

There is virtually no risk.

### **Considerations**

If you have gonorrhea or another sexually transmitted disease, it is very important that all of your sexual partners also receive treatment, even if they have no symptoms.

### **Endometrial biopsy**

#### **Definition**

Endometrial biopsy is the removal of a small piece of tissue from the lining of the uterus (endometrium) for examination.

#### **Alternative Names**

Biopsy - endometrium

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

This procedure may be done with or without anesthesia. This is medicine that allows you to sleep during the procedure.

- You lie on your back with your feet in stirrups, similar to having a pelvic exam.
- Your health care provider gently inserts an instrument (speculum) into the vagina to hold it open so that your cervix can be viewed. The cervix is cleaned with a special liquid. Numbing medicine may be applied to the cervix.
- The cervix may then be gently grasped with an instrument to hold the uterus steady. Another instrument may be needed to gently stretch the cervical opening if there is tightness.
- An instrument is gently passed through the cervix into the uterus to collect the tissue sample.
- The tissue sample and instruments are removed.
- The tissue is sent to a lab. There, it is examined under a microscope.
- If you had anesthesia for the procedure, you are taken to a recovery area. Nurses will make sure you are comfortable. After you wake up and have no problems from the anesthesia and procedure, you are allowed to go home.

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

Before the test:

- Tell your provider about all the medicines you take. These include blood thinners such as warfarin, clopidogrel, and aspirin.
- You may be asked to have a test to make sure you are not pregnant.
- In the 2 days before the procedure, do not use creams or other medicines in the vagina.
- Do NOT douche. (You should never douche. Douching can cause infection of the vagina or uterus.)

- Ask your provider if you should take pain medicine, such as ibuprofen or acetaminophen, just before the procedure.

### **How the Test will Feel**

The instruments may feel cold. You may feel some cramping when the cervix is grasped. You may have some mild cramping as the instruments enter the uterus and the sample is collected. The discomfort is mild, though for some women it can be severe. However, the duration of the test and the pain are short.

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

The test is done to find the cause of:

- Abnormal menstrual periods (heavy, prolonged, or irregular bleeding)
- Bleeding after menopause
- Bleeding from taking hormone therapy medicines
- Thickened uterine lining seen on ultrasound
- Endometrial cancer

### **Normal Results**

The biopsy is normal if the cells in the sample are not abnormal.

### **What Abnormal Results Mean**

Abnormal menstrual periods may be caused by:

- Uterine fibroids
- Fingerlike growths in the uterus (uterine polyps)
- Infection
- Hormone imbalance
- Endometrial cancer or precancer (hyperplasia)

Other conditions under which the test may be performed:

- Abnormal bleeding if a woman is taking the breast cancer medicine tamoxifen
- Abnormal bleeding due to changes in hormone levels (anovulatory bleeding)

### **Risks**

Risks for endometrial biopsy include:

- Infection
- Causing a hole in (perforating) the uterus or tearing the cervix (rarely occurs)
- Prolonged bleeding
- Slight spotting and mild cramping for a few days

## **Endoscopic ultrasound**

### **Definition**

Endoscopic ultrasound is a type of imaging test. It is used to see organs in and near the digestive tract.

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

Ultrasound is a way to see the inside of the body using high-frequency sound waves. Endoscopic ultrasound does this with a thin, flexible tube called an endoscope.

- This tube is passed either through the mouth or through the rectum and into the digestive tract.
- Sound waves are sent out the end of the tube and bounce off the organs in the body.
- A computer receives these waves and uses them to create a picture of what is inside.
- This test does not expose you to harmful radiation.

If a sample or biopsy is needed, a thin needle can be passed through the tube to collect fluid or tissue. This does not hurt.

The test takes 30 to 90 minutes to complete.

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

Your health care provider will tell you what to do. You will be told when to stop drinking and eating before the test.

Give your provider a list of all the medicines you take (prescription and over-the-counter), herbs, and supplements. You will be told when you can take these. Some need to be stopped a week before the test. Ask your provider which medicines you should take on the morning of surgery. Since you will not be able to drive or return to work on the day of this test, you will need someone to take you home.



### **How the Test will Feel**

Before this test you will get medicine through an IV to help you relax (a sedative). You may fall asleep or not remember the test. Some people feel the test is slightly uncomfortable.

For the first hour after this test, you may feel sleepy and unable to drink or walk. You may have a sore throat. Air or carbon dioxide gas may have been put in your digestive tract during the test to move the tube more easily. This may make you feel bloated, but this feeling will go away.

When you are fully awake, you can be taken home. Rest that day. You may have fluids and light meals.

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

You may have this test to:

- Find the cause of abdominal pain
- Find the cause of weight loss
- Diagnose diseases of the pancreas, bile duct, and gallbladder
- Guide a biopsy of tumors, lymph nodes, and other tissue
- Look at cysts, tumors, and cancers
- Look for stones in the bile duct

This test can also stage cancers of the:

- Esophagus
- Stomach
- Pancreas
- Rectum

### **Normal Results**

The organs will appear normal.

### **What Abnormal Results Mean**

The results depend on what is found during the test. If you DO NOT understand the results, or have questions or concerns, talk to your provider.

### **Risks**

Risks for any sedation are:

- Reactions to medicine
- Problems breathing

Complications from this test include:

- Bleeding
- A tear in the lining of the digestive tract
- Infection
- Pancreatitis

## **Endoscopy**

### **Definition**

Endoscopy is a way of looking inside the body using a flexible tube that has a small camera and light on the end of it. This instrument is called an endoscope.

Small instruments can be inserted through an endoscope and used to:

- Look more closely at an area inside the body
- Take samples of abnormal tissues
- Treat certain diseases
- Remove tumors
- Stop bleeding
- Remove foreign bodies (such as food stuck in the esophagus, the tube that connects your throat to your stomach)

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

An endoscope is passed through a natural body opening or small cut. There are many types of endoscopes. Each one is named according to the organs or areas they are used to examine.

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

Preparation for the procedure varies depending on the test. For example, there is no preparation needed for anoscopy. But a special diet and laxatives are needed to prepare for a colonoscopy.

Follow your health care provider's instructions.

### **How the Test will Feel**

All of these tests may cause discomfort or pain. Some are done after sedatives and pain medicines are given. Check with your provider about what to expect.

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

Each endoscopy test is done for different reasons. Endoscopy is often used to examine and treat parts of the digestive tract, such as:

- Anoscopy views the inside of the anus, the very lowest part of the colon.
- Colonoscopy views the inside of the colon (large intestine) and rectum.
- Enteroscopy views the small intestine (small bowel).
- ERCP (endoscopic retrograde cholangiopancreatography) views the biliary tract, small tubes that drain the gallbladder, liver, and pancreas.
- Sigmoidoscopy views the inside of the lower part of the colon called the sigmoid colon and rectum.
- Upper endoscopy (esophagogastroduodenoscopy, or EGD) views the lining of the esophagus, stomach, and first part of the small intestine (called the duodenum).
- Bronchoscopy is used to look in the airways (windpipe, or trachea) and lungs.
- Cystoscopy is used to view the inside of the bladder. The scope is passed through the opening of the urethra.
- Laparoscopy is used to look directly at the ovaries, appendix, or other abdominal organs. The scope is inserted through small surgical cuts in the pelvic or belly area. Tumors or organs in the abdomen or pelvis can be removed.

Arthroscopy is used to look directly in the joints, such as the knee. The scope is inserted through small surgical cuts around the joint. Problems with bones, tendons, ligaments can be treated.

### **Risks**

Each endoscopy test has its own risks. Your provider will explain these to you before the procedure.

### **Endotracheal intubation**

#### **Definition**

Endotracheal intubation is a medical procedure in which a tube is placed into the windpipe (trachea) through the mouth or nose. In most emergency situations, it is placed through the mouth.

#### **Alternative Names**

Intubation - endotracheal

#### **Description**

Whether you are awake (conscious) or not awake (unconscious), you will be given medicine to make it easier and more comfortable to insert the tube. You may also get medicine to relax.

The provider will insert a device called a laryngoscope to be able to view the vocal cords and the upper part of the windpipe.

If the procedure is being done to help with breathing, a tube is then inserted into the windpipe and past the vocal cords to just above the spot above where the trachea branches into the lungs. The tube can then be used to connect with a mechanical ventilator to assist breathing.

#### **Why the Procedure Is Performed**

Endotracheal intubation is done to:

- Keep the airway open in order to give oxygen, medicine, or anesthesia.
- Support breathing in certain illnesses, such as pneumonia, emphysema, heart failure, collapsed lung or severe trauma.
- Remove blockages from the airway.
- Allow the provider to get a better view of the upper airway.
- Protect the lungs in people who are unable to protect their airway and are at risk for breathing in fluid (aspiration). This includes people with certain types of strokes, overdoses, or massive bleeding from the esophagus or stomach.

### **Risks**

Risks include:

- Bleeding
- Infection
- Trauma to the voice box (larynx), thyroid gland, vocal cords and windpipe (trachea), or esophagus

- Puncture or tearing (perforation) of body parts in the chest cavity, leading to lung collapse

### **Before the Procedure**

The procedure is most often done in emergency situations, so there are no steps you can take to prepare.

### **After the Procedure**

You will be in the hospital to monitor your breathing and your blood oxygen levels. You may be given oxygen or placed on a breathing machine. If you are awake, your health care provider may give you medicine to reduce your anxiety or discomfort.

### **Outlook (Prognosis)**

The outlook will depend on the reason the procedure needed to be done.

### **Enteroclysis**

#### **Definition**

Enteroclysis is an imaging test of the small intestine. The test looks at how a liquid called contrast material moves through the small intestine.

#### **Alternative Names**

Small bowel enema; CT enteroclysis; Small bowel follow-through; Barium enteroclysis; MR enteroclysis

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

This test is done in a radiology department. Depending on the need, x-ray, CT scan, or MRI imaging is used.

The test involves the following:

- The health care provider inserts a tube through your nose or mouth into your stomach and into the beginning of the small bowel.
- Contrast material and air flows through the tube, and images are taken.

The provider can watch on a monitor as the contrast moves through the bowel.

The goal of the study is to view all of the loops of small bowel. You may be asked to change positions during the exam. The test may last a few hours, because it takes a while for the contrast to move through all of the small bowel.

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

Follow your provider's instructions on how to prepare for the test, which may include:

- Drinking clear liquids for at least 24 hours before the test.
- Not eating or drinking anything for several hours before the test. Your provider will tell you exactly how many hours.
- Taking laxatives to clear the bowels.
- Not taking certain medicines. Your provider will tell you which ones. DO NOT stop taking any medicines on your own. Ask your provider first.

If you are anxious about the procedure, you may be given a sedative before it starts. You will be asked to remove all jewelry and wear a hospital gown. It is best to leave jewelry and other valuables at home. You will be asked to remove any removable dental work, such as appliances, bridges, or retainers.

If you are, or think you're pregnant, tell the provider before the test.

#### **How the Test will Feel**

The placement of the tube may be uncomfortable. The contrast material may cause a feeling of abdominal fullness.

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

This test is performed to examine the small bowel. It is the most complete way of telling if the small intestine is normal.

#### **Normal Results**

There are no problems seen with the size or shape of the small intestine. Contrast travels through the bowel at a normal rate without any sign of blockage.

#### **What Abnormal Results Mean**

Many problems of the small intestine can be found with enteroclysis. Some of these include:

- Inflammation of the small bowel (such as Crohn disease)
- Small bowel isn't absorbing nutrients normally (malabsorption)

- Narrowing or stricture of the intestine
- Small bowel blockage
- Tumors of the small intestine

### **Risks**

The radiation exposure may be greater with this test than with other types of x-rays because of the length of time. But most experts feel that the risk is low compared to the benefits.

Pregnant women and children are more sensitive to the risks of x-ray radiation. Rare complications include:

- Allergic reactions to medicines prescribed for the test (your provider can tell you which medicines)
- Possible injury to bowel structures during the study

Barium may cause constipation. Tell your provider if the barium has not passed through your system by 2 or 3 days after the test, or if you feel constipated.

### **Enteroscopy**

#### **Definition**

Enteroscopy is a procedure used to examine the small intestine (small bowel).

#### **Alternative Names**

Push enteroscopy; Double-balloon enteroscopy; Capsule enteroscopy

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

A thin, flexible tube (endoscope) is inserted through the mouth and into the upper gastrointestinal tract. During a double-balloon enteroscopy, balloons attached to the endoscope can be inflated to allow the doctor to view a section of the small intestine.

In a colonoscopy, a flexible tube is inserted through your rectum and colon. The tube can most often reach into the end part of the small intestine (ileum). Capsule endoscopy is done with a disposable capsule that you swallow.

Tissue samples removed during enteroscopy are sent to the lab for examination. (Biopsies cannot be taken with a capsule endoscopy.)

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

Do not take products containing aspirin for 1 week before the procedure. Tell your health care provider if you take blood thinners such as warfarin (Coumadin), clopidogrel (Plavix), or apixaban (Eliquis) because these may interfere with the test. Do NOT stop taking any medicine unless told to do so by your provider.

Do not eat any solid foods or milk products after midnight the day of your procedure. You may have clear liquids until 4 hours before your exam.

You must sign a consent form.

#### **How the Test will Feel**

You will be given calming and sedating medicine for the procedure and will not feel any discomfort. You may have some bloating or cramping when you wake up. This is from air that is pumped into the abdomen to expand the area during the procedure.

A capsule endoscopy causes no discomfort.

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

This test is most often performed to help diagnose diseases of the small intestines. It may be done if you have:

- Abnormal x-ray results
- Tumors in the small intestines
- Unexplained diarrhea
- Unexplained gastrointestinal bleeding

#### **Normal Results**

In a normal test result, the provider will not find sources of bleeding in the small bowel, and will not find any tumors or other abnormal tissue.

#### **What Abnormal Results Mean**

Signs may include:

- Abnormalities of the tissue lining the small intestine (mucosa) or the tiny, finger-like projections on the surface of the small intestine (villi)
- Abnormal lengthening of blood vessels (angioectasis) in the intestinal lining

- Immune cells called PAS-positive macrophages
- Polyps or cancer
- Radiation enteritis
- Swollen or enlarged lymph nodes or lymphatic vessels
- Ulcers

Changes found on enteroscopy may be signs of disorders and conditions, including:

- Amyloidosis
- Celiac sprue
- Crohn disease
- Folate or vitamin B12 deficiency
- Giardiasis
- Infectious gastroenteritis
- Lymphangiectasia
- Lymphoma
- Small intestinal angiectasia
- Small intestinal cancer
- Tropical sprue
- Whipple disease

### **Risks**

Complications are rare but may include:

- Excessive bleeding from the biopsy site
- Hole in the bowel (bowel perforation)
- Infection of the biopsy site leading to bacteremia
- Vomiting, followed by aspiration into the lungs
- The capsule endoscope can cause a blockage in a narrowed intestine with symptoms of abdominal pain and bloating

### **Considerations**

Factors that prohibit use of this test may include:

- Uncooperative or confused person
- Untreated blood clotting (coagulation) disorders
- Use of aspirin or other medicines that prevent the blood from clotting normally (anticoagulants)

The greatest risk is bleeding. Signs include:

- Abdominal pain
- Blood in the stools
- Vomiting blood

### **Eosinophil count - absolute**

#### **Definition**

An absolute eosinophil count is a blood test that measures the number of one type of white blood cells called eosinophils. Eosinophils become active when you have certain allergic diseases, infections, and other medical conditions.

#### **Alternative Names**

Eosinophils; Absolute eosinophil count

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

Most of the time, blood is drawn from a vein on the inside of the elbow or the back of the hand. The site is cleaned with an antiseptic. The health care provider wraps an elastic band around your upper arm to make the vein swell with blood.

Next, the provider gently inserts a needle into the vein. The blood collects into an airtight tube attached to the needle. The elastic band is removed from your arm. The needle is then removed and the site is covered to stop bleeding.

In infants or young children, a sharp tool called a lancet may be used to prick the skin. The blood collects in a small glass tube, or onto a slide or test strip. A bandage is put on the spot to stop bleeding.

In the lab, the blood is placed on a microscope slide. A stain is added to the sample. This causes eosinophils to show up as orange-red granules. The technician then counts how many eosinophils are present per 100 cells. The percentage of eosinophils is multiplied by the white blood cell count to give the absolute eosinophil count.

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

Most of the time, adults do not need to take special steps before this test. Tell your provider the medicines you are taking, including the ones without a prescription. Some drugs may change the test results.

Medicines that may cause you to have an increase in eosinophils include:

- Amphetamines (appetite suppressants)
- Certain laxatives containing psyllium
- Certain antibiotics
- Interferon
- Tranquilizers

### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

You will have this test to see if you have abnormal results from a blood differential test. This test may also be done if the provider thinks you may have a specific disease.

This test may help diagnose:

- Acute hypereosinophilic syndrome (a rare, but sometimes fatal leukemia-like condition)
- An allergic reaction (can also reveal how severe the reaction is)
- Early stages of Addison disease
- Infection by a parasite

### **Normal Results**

Normal eosinophil count is less than 500 cells per microliter (cells/mcL).

Normal value ranges may vary slightly among different laboratories. Talk to your provider about the meaning of your specific test results.

The example above shows the common measurements for results of these tests. Some laboratories use different measurements or may test different specimens.

### **What Abnormal Results Mean**

A high number of eosinophils (eosinophilia) are often linked to a variety of disorders. A high eosinophil count may be due to:

- Adrenal gland deficiency
- Allergic disease, including hay fever
- Asthma
- Autoimmune diseases
- Eczema
- Fungal infections
- Hypereosinophilic syndrome
- Leukemia and other blood disorders
- Lymphoma
- Parasite infection, such as worms

A lower-than-normal eosinophil count may be due to:

- Alcohol intoxication
- Overproduction of certain steroids in the body (such as cortisol)

### **Risks**

Risks from having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Considerations**



The eosinophil count is used to help confirm a diagnosis. The test cannot tell if the higher number of cells is caused by allergy or parasite infection.

### **Eosinophilic esophagitis**

#### **Definition**

Eosinophilic esophagitis involves a buildup of white blood cells in the lining of your esophagus. The esophagus is the tube that carries food from your mouth to your stomach. The buildup of white blood cells (called eosinophils) is due to a reaction to foods, allergens, or acid reflux.

#### **Causes**

The exact cause of eosinophilic esophagitis is not known. It is believed that an immune reaction to certain foods leads to a buildup of eosinophils. As a result, the lining of the esophagus becomes swollen and inflamed.

Most people with this disorder have a family or personal history of allergies or asthma. Triggers such as mold, pollen, and dust mites may also play a role.

#### **Symptoms**

Eosinophilic esophagitis can affect both children and adults.

Symptoms in children include:

- Problems feeding or eating
- Abdominal pain
- Vomiting
- Problems swallowing
- Food getting stuck in the esophagus
- Poor weight gain or weight loss, poor growth, and malnutrition

Symptoms in adults include:

- Food getting stuck when swallowing
- Chest pain
- Heartburn
- Upper abdominal pain
- Backflow of undigested food (regurgitation)
- Reflux that does not get better with medicine

#### **Exams and Tests**

Your health care provider will take a detailed history and perform a physical exam. This is done to check for food allergies and to rule out other conditions, such as gastroesophageal reflux disease (GERD).

Tests that may be done include:

- Blood tests
- Allergy skin test
- Upper endoscopy
- Biopsy of the lining of the esophagus

#### **Treatment**

There is no cure and no specific treatment for eosinophilic esophagitis. Treatment involves managing your diet and taking medicines.

If you test positive for food allergies, you may be told to avoid those foods. Or you may avoid all foods that are known to trigger this problem. Common foods to avoid include seafood, eggs, nuts, soy, wheat, and dairy. Allergy testing may discover specific foods to avoid.

Proton pump inhibitors can help control symptoms, but they don't help the problem causing symptoms.

Your provider may prescribe topical steroids taken orally. You also may take oral steroids for a short time. Topical steroids don't have the same side effects as oral steroids.

If you develop narrowing or strictures, a procedure to open up or dilate the area may be needed.

You and your provider will work together to find a treatment plan that works best for you.

#### **Support Groups**

Support groups such as American Partnership for Eosinophilic Disorders can help you understand more about the eosinophilic esophagitis. You can also learn ways to manage your condition and cope with the disease.

**Outlook (Prognosis)**

Eosinophilic esophagitis is long-term (chronic) disease that comes and goes over a person's lifetime.

**Possible Complications**

Possible complications may include:

- Narrowing of the esophagus (a stricture)
- Food getting stuck in the esophagus (common in children)
- Severe swelling and irritation of the esophagus

**When to Contact a Medical Professional**

Contact your provider if you have symptoms of eosinophilic esophagitis.

**Epstein-Barr virus antibody test****Definition**

Epstein-Barr virus antibody test is a blood test to detect antibodies to the Epstein-Barr virus (EBV), which is a cause of the infection mononucleosis.

**Alternative Names**

EBV antibody test; EBV serology

**How the Test is Performed**

A blood sample is needed.

The sample is sent to a lab, where a lab specialist looks for antibodies to the Epstein-Barr virus. In the first stages of an illness, little antibody may be detected. For this reason, the test is often repeated in 10 days to 2 or more weeks.

**How to Prepare for the Test**

There is no special preparation for the test.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

**Why the Test is Performed**

The test is done to detect an infection with the Epstein-Barr virus (EBV). EBV causes mononucleosis or mono. The EBV antibody test detects not only a recent infection, but also one that occurred in the past. It can be used to tell the difference between a recent or previous infection.

Another test for mononucleosis is called the spot test. It is done when a person has current symptoms of mononucleosis.

**Normal Results**

A normal result means no antibodies to EBV were seen in your blood sample. This result means you have never been infected with EBV.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

**What Abnormal Results Mean**

A positive result means there are antibodies to EBV in your blood. This indicates a current or prior infection with EBV.

**Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

**Eruptive xanthomatosis****Definition**

Eruptive xanthomatosis is a skin condition that causes small yellow-red bumps to appear on the body. It can occur in people who have very high blood fats (lipids). These patients also frequently have diabetes.

### **Alternative Names**

Eruptive xanthoma; Eruptive xanthomata; Xanthoma - eruptive; Diabetes - xanthoma

### **Causes**

Eruptive xanthomatosis is a rare skin condition caused by excessively high lipids in the blood. It can occur in people with poorly-controlled diabetes who have very high triglycerides and high cholesterol.

Cholesterol and triglycerides are types of fats that naturally occur in your blood. High levels increase the risk for heart disease and other health problems.

When diabetes is not well-controlled, there is less insulin in the body. Low insulin levels makes it harder for the body to break down fats in the blood. This increases the level of fats in the blood.

The extra fat can collect under the skin to form small bumps (lesions).

### **Symptoms**

The skin bumps may vary in color from yellow, orange-yellow, red-yellow, to red. A small red halo may form around the bump. The bumps are:

- Pea-sized
- Waxy
- Firm

While harmless, the bumps may be itchy and tender. They tend to appear on the:

- Buttocks
- Shoulders
- Arms
- Thighs
- Legs

### **Exams and Tests**

Your health care provider will take your medical history and examine your skin. You may have the following blood tests:

- Blood test for cholesterol and triglycerides
- Blood sugar test for diabetes
- Pancreatic function test

A skin biopsy may be done to help diagnose the condition.

### **Treatment**

Treatment for eruptive xanthomatosis involves lowering:

- Blood fats
- Blood sugar

Your health care provider will ask you to make changes in your lifestyle and diet. This can help lower high blood fats.

If you have diabetes, your provider will ask you to manage your blood sugar [pid=60&gid=000086] through diet, exercise, and medicines.

If lifestyle changes do not work, your provider may ask you to take medicines to help lower blood fat levels, such as:

- Statins
- Fibrates
- Lipid-lowering antioxidants
- Niacin
- Bile acid resins

The skin bumps go away by themselves after few weeks. They clear once the blood sugar and fat levels are under control.

### **Possible Complications**

If not treated, high triglyceride levels can lead to pancreatitis.

### **When to Contact a Medical Professional**

Call your health care provider if you:

- Have poor control of diabetes

- Notice yellowish-red bumps on your skin

### **Prevention**

Control of blood fats and blood sugar can help prevent this condition. Follow your provider's treatment recommendations.

### **Erythropoietin test**

#### **Definition**

The erythropoietin test measures the amount of a hormone called erythropoietin (EPO) in blood. The hormone tells stem cells in the bone marrow to make more red blood cells. EPO is made by cells in the kidney. These cells release more EPO when blood oxygen level is low.

#### **Alternative Names**

Serum erythropoietin; EPO

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

A blood sample is needed.

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

No special preparation is necessary.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging sensation. Afterward, there may be some throbbing.

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

This test may be used to help determine the cause of anemia, polycythemia (high red blood cell count) or other bone marrow disorders.

A change in red blood cells will affect the release of EPO. For example, people with anemia have too few red blood cells, so more EPO is produced.

#### **Normal Results**

The normal range is 2.6 to 18.5 milliunits per milliliter (mU/mL).

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test result.

#### **What Abnormal Results Mean**

Increased EPO level may be due to secondary polycythemia. This is an overproduction of red blood cells that occurs in response to an event such as low blood oxygen level. The condition may occur at high altitudes or, rarely, because of a tumor that releases EPO.

Lower-than-normal EPO level may be seen in chronic kidney failure, anemia of chronic disease, or polycythemia vera.

#### **Risks**

Risks associated with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Esophageal culture**

#### **Definition**

Esophageal culture is a laboratory test that checks for infection-causing germs (bacteria, viruses, or fungi) in a sample of tissue from the esophagus.

#### **Alternative Names**

Culture - esophageal

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

A sample of tissue from your esophagus is needed. The sample is taken during a procedure called esophagogastroduodenoscopy (EGD). The tissue is removed by using a tiny tool or a brush at the end of the scope.

The sample is sent to a lab. There, it is placed in a special dish (culture) and watched for the growth of bacteria, fungi, or viruses.

Other tests may be done to determine what medicine can best treat the organism.

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

Follow your health care provider's instructions on how to prepare for EGD.

**How the Test will Feel**

During EGD, you will receive medicine to relax you. You may have some discomfort or feel like gagging as the endoscope is passed through your mouth and throat into the esophagus. This feeling will go away shortly.

**Why the Test is Performed**

Your doctor may order this test if you have signs or symptoms of an esophageal infection or disease. You may also have the test if an ongoing infection does not get better with treatment.

**Normal Results**

A normal result means that no germs grew in the laboratory dish.

Normal value ranges may vary slightly among different laboratories. Talk to your doctor about the meaning of your specific test results.

**What Abnormal Results Mean**

An abnormal result means germs grew in the laboratory dish. This is a sign of an infection of the esophagus, which may be due to bacteria, a virus, or a fungus.

**Risks**

Risks are related to the EGD procedure. Your provider can explain these risks.

**Esophageal manometry****Definition**

Esophageal manometry is a test to measure how well the esophagus is working.

**Alternative Names**

Esophageal motility studies; Esophageal function studies

**How the Test is Performed**

During esophageal manometry, a thin, pressure-sensitive tube is passed through your nose, down the esophagus, and into your stomach.

Before the procedure, you receive numbing medicine inside the nose. This helps make the insertion of the tube less uncomfortable.

After the tube is in the stomach, the tube is pulled slowly back into your esophagus. At this time, you are asked to swallow. The pressure of the muscle contractions is measured along several sections of the tube.

While the tube is in place, other studies of your esophagus may be done. The tube is removed after the tests are completed. The test takes about 1 hour.

**How to Prepare for the Test**

You should not have anything to eat or drink for 8 hours before the test. If you have the test in the morning, DO NOT eat or drink after midnight.

Tell your health care provider about all medicines you are taking. These include vitamins, herbs, and other over-the-counter medicines and supplements.

**How the Test will Feel**

You may have a gagging sensation and discomfort when the tube passes through your nose and throat. You may also feel discomfort in your nose and throat during the test.

**Why the Test is Performed**

The esophagus is the tube that carries food from your mouth into the stomach. When you swallow, muscles in your esophagus squeeze (contract) to push food toward the stomach. Valves, or sphincters, inside the esophagus open to let food and liquid through. They then close to prevent food, fluids, and stomach acid from moving backward. The sphincter at the bottom of the esophagus is called the lower esophageal sphincter, or LES.

Esophageal manometry is done to see if the esophagus is contracting and relaxing properly. The test helps diagnose swallowing problems. During the test, the doctor can also check the LES to see if it opens and closes properly.

The test may be ordered if you have symptoms of:

- Heartburn or nausea after eating (gastroesophageal reflux disease, or GERD)
- Problems swallowing (feeling like food is stuck behind the breast bone)

**Normal Results**

The LES pressure and muscle contractions are normal when you swallow.

**What Abnormal Results Mean**

Abnormal results may indicate:

- A problem with the esophagus that affects its ability to move food toward the stomach (achalasia)
- A weak LES, which causes heartburn (GERD)
- Abnormal contractions of the esophagus muscles that do not effectively move food to the stomach (esophageal spasm)

### **Risks**

Risks of this test include:

- Slight nosebleed
- Sore throat
- Hole, or perforation, in the esophagus (this rarely happens)

### **Esophageal pH monitoring**

#### **Definition**

Esophageal pH monitoring is a test that measures how often stomach acid enters the tube that leads from the mouth to the stomach (called the esophagus). The test also measures how long the acid stays there.

#### **Alternative Names**

pH monitoring - esophageal; Esophageal acidity test

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

A thin tube is passed through your nose or mouth to your stomach. The tube is then pulled back into your esophagus. A monitor attached to the tube measures the acid level in your esophagus. You will wear the monitor on a strap and record your symptoms and activity over the next 24 hours in a diary. You will return to the hospital the next day and the tube will be removed. The information from the monitor will be compared with your diary notes.

Infants and children may need to stay in the hospital for the esophageal pH monitoring.

A newer method of monitoring esophageal acid (pH monitoring) is by use of a wireless pH probe.

- This capsule-like device is attached to the lining of the upper esophagus with an endoscope.
- It remains in the esophagus where it measures acidity and transmits pH levels to a recording device worn on the wrist.
- The capsule falls off after a 4 to 10 days and moves down through gastrointestinal tract. It is then expelled with a bowel movement and flushed down the toilet.

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

Your health care provider will ask you to not eat or drink after midnight before the test. You should also avoid smoking.

Some medicines may change the test results. Your provider may ask you to not take these for between 24 hours and 2 weeks (or more) before the test. You also may be told to avoid alcohol.

Medicines that you may need to stop include:

- Adrenergic blockers
- Antacids
- Anticholinergics
- Cholinergics
- Corticosteroids
- H<sub>2</sub> blockers
- Proton pump inhibitors

DO NOT stop taking any medicine unless told to do so by your provider.

#### **How the Test will Feel**

You briefly feel like gagging as the tube is passed through your throat.

The Bravo pH monitor causes no discomfort.

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

Esophageal pH monitoring is used to check how much stomach acid is entering the esophagus. It also checks how well the acid is cleared downward into the stomach. It is a test for gastroesophageal reflux disease (GERD).

In infants, this test is also used to check for GERD and other problems related to excessive crying.

#### **Normal Results**



Normal value ranges may vary depending on the lab doing the test. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Increased acid in the esophagus may be related to:

- Barrett esophagus
- Difficulty swallowing (dysphagia)
- Esophageal scarring
- Gastroesophageal reflux disease (GERD)
- Heartburn
- Reflux esophagitis

You may need to have the following tests if your provider suspects esophagitis:

- Barium swallow
- Esophagogastroduodenoscopy (also called upper GI endoscopy)

### **Risks**

Rarely, the following may occur:

- Arrhythmias during insertion of the tube
- Breathing in of vomit if the catheter causes vomiting

## **ESR**

### **Definition**

ESR stands for erythrocyte sedimentation rate. It is commonly called a "sed rate."

It is a test that indirectly measures how much inflammation is in the body.

### **Alternative Names**

Erythrocyte sedimentation rate; Sed rate; Sedimentation rate

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

A blood sample is needed. Most of the time, blood is drawn from a vein located on the inside of the elbow or the back of the hand. The blood sample is sent to a lab.

The test measures how fast red blood cells (called erythrocytes) fall to the bottom of a tall, thin tube.

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

There are no special steps needed to prepare for this test.

### **How the Test will Feel**

You may feel slight pain or a sting when the needle is inserted. You may also feel some throbbing at the site after the blood is drawn.

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

Reasons why a "sed rate" may be done include:

- Unexplained fevers
- Certain types of joint pain or arthritis
- Muscle symptoms
- Other vague symptoms that cannot be explained

This test may also be used to monitor whether an illness is responding to treatment.

This test can be used to monitor inflammatory diseases or cancer. It is not used to diagnose a specific disorder.

However, the test is useful for detecting and monitoring:

- Autoimmune disorders
- Bone infections
- Certain forms of arthritis
- Inflammatory diseases

### **Normal Results**

For adults (Westergren method):

- Men under 50 years old: less than 15 mm/hr
- Men over 50 years old: less than 20 mm/hr
- Women under 50 years old: less than 20 mm/hr
- Women over 50 years old: less than 30 mm/hr

For children (Westergren method):

- Newborn: 0 to 2 mm/hr

- Newborn to puberty: 3 to 13 mm/hr

Note: mm/hr = millimeters per hour

Normal value ranges may vary slightly among different laboratories. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

An abnormal ESR may help with a diagnosis, but it does not prove that you have a certain condition. Other tests are almost always needed.

An increased ESR rate may occur in people with:

- Anemia
- Cancers such as lymphoma or multiple myeloma
- Kidney disease
- Pregnancy
- Thyroid disease

The immune system helps protect the body against harmful substances. An autoimmune disorder is when the immune system mistakenly attacks and destroys healthy body tissue. ESR is often higher than normal in people with an autoimmune disorder.

Common autoimmune disorders include:

- Lupus
- Polymyalgia rheumatica
- Rheumatoid arthritis in adults or children

Very high ESR levels occur with less common autoimmune or other disorders, including:

- Allergic vasculitis
- Giant cell arteritis
- Hyperfibrinogenemia (increased fibrinogen levels in the blood)
- Macroglobulinemia - primary
- Necrotizing vasculitis

An increased ESR rate may be due to some infections, including:

- Bodywide (systemic) infection
- Bone infections
- Infection of the heart or heart valves
- Rheumatic fever
- Severe skin infections, such as erysipelas
- Tuberculosis

Lower-than-normal levels occur with:

- Congestive heart failure
- Hyperviscosity
- Hypofibrinogenemia (decreased fibrinogen levels)
- Leukemia
- Low plasma protein (due to liver or kidney disease)
- Polycythemia
- Sickle cell anemia

### **Estradiol blood test**

#### **Definition**

An estradiol test measures the amount of a hormone called estradiol in the blood. Estradiol is one of the main types of estrogens.

#### **Alternative Names**

E2 test

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

A blood sample is needed.

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

Your health care provider may tell you to temporarily stop taking certain medicines that may affect test results. Be sure to tell your provider about all the medicines you take. These include:

- Birth control pills
- Antibiotics such as ampicillin or tetracycline
- Corticosteroids

- DHEA (a supplement)
- Estrogen
- Medicine to manage mental disorders (such as phenothiazine)
- Testosterone

DO NOT stop taking any medicine before talking to your doctor.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

In women, most estradiol is released from the ovaries and adrenal glands. It is also released by the placenta during pregnancy. Estradiol is also produced in other body tissues, such as skin, fat, cells bone, brain, and liver. Estradiol plays a role in:

- Growth of the womb (uterus), fallopian tubes, and vagina
- Breast development
- Changes of the outer genitals
- Distribution of body fat
- Menopause

In men, a small amount of estradiol is mainly released by the testes. Estradiol helps prevent sperm from dying too early.

This test may be ordered to check:

- How well your ovaries, placenta, or adrenal glands work
- If you have signs of an ovarian tumor
- If male or female body characteristics are not developing normally
- If your periods have stopped (levels of estradiol vary, depending on the time of month)

The test may also be ordered to check if:

- Hormone therapy is working for women in menopause
- A woman is responding to fertility treatment

The test may also be used to monitor people with hypopituitarism and women on certain fertility treatments.

### **Normal Results**

The results may vary, depending on the person's gender and age.

- Male - 10 to 50 pg/mL (36.7 to 183.6 pmol/L)
- Female (premenopausal) - 30 to 400 pg/mL (110 to 1468.4 pmol/L)
- Female (postmenopausal) - 0 to 30 pg/mL (0 to 110 pmol/L)

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test result.

### **What Abnormal Results Mean**

Disorders that are associated with abnormal estradiol results include:

- Early (precocious) puberty in girls
- Growth of abnormally large breasts in men (gynecomastia)
- Lack of periods in women (amenorrhea)
- Reduced function of the ovaries (ovarian hypofunction)
- Problem with genes, such as Klinefelter syndrome, Turner syndrome
- Rapid weight loss or low body fat

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Ethylene glycol blood test**

### **Definition**

This test measures the level of ethylene glycol in the blood.

Ethylene glycol is a type of alcohol found in automotive and household products. It does not have color or odor. It tastes sweet. Ethylene glycol is poisonous. People sometimes drink ethylene glycol by mistake or on purpose as a substitute for drinking alcohol.

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

A blood sample is needed.

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

No special preparation is needed.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel slight pain. Others feel a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is ordered when a health care provider thinks someone has been poisoned by ethylene glycol. Drinking ethylene glycol is a medical emergency. Ethylene glycol can damage the brain, liver, kidneys, and lungs. The poisoning disturbs the body's chemistry and can lead to condition called metabolic acidosis. In severe cases, shock, organ failure, and death can result.

### **Normal Results**

There should be no ethylene glycol present in the blood.

### **What Abnormal Results Mean**

Abnormal results are a sign of possible ethylene glycol poisoning.

### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person to another, and from one side of the body to the other. Taking 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Exercise stress test**

### **Definition**

An exercise stress test is used to measure the effect of exercise on your heart.

### **Alternative Names**

Exercise ECG; ECG - exercise treadmill; EKG - exercise treadmill; Stress ECG; Exercise electrocardiography; Stress test - exercise treadmill; CAD - treadmill; Coronary artery disease - treadmill; Chest pain - treadmill; Angina - treadmill; Heart disease - treadmill

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

This test is done at a medical center or health care provider's office.

The technician will place 10 flat, sticky patches called electrodes on your chest. These patches are attached to an ECG monitor that follows the electrical activity of your heart during the test.

You will walk on a treadmill or pedal on an exercise bicycle. Slowly (about every 3 minutes), you will be asked to walk (or pedal) faster and on an incline or with more resistance. It is like walking fast or jogging up a hill.

While you exercise, the activity of your heart is measured with an electrocardiogram (ECG). Your blood pressure readings are also taken.

The test continues until:

- You reach a target heart rate.
- You develop chest pain or a change in your blood pressure that is concerning.
- ECG changes suggest that your heart muscle is not getting enough oxygen.
- You are too tired or have other symptoms, such as leg pain, that keep you from continuing.

You will be monitored for 10 to 15 minutes after exercising, or until your heart rate returns to baseline. The total time of the test is around 60 minutes.

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

Wear comfortable shoes and loose clothing to allow you to exercise.

Ask your provider if you should take any of your regular medicines on the day of the test. Some medicines may interfere with test results. Never stop taking any medicine without first talking to your doctor.

Tell your doctor if you are taking sildenafil citrate (Viagra), tadalafil (Cialis), or vardenafil (Levitra) and have taken a dose within the past 24 to 48 hours.

You must not eat, smoke, or drink beverages containing caffeine or alcohol for 3 hours (or more) before the test. In most cases, you will be asked to avoid caffeine for 24 hours before the test. This includes:

- Tea and coffee
- All sodas, even ones that are labeled caffeine-free
- Chocolates
- Certain pain relievers that contain caffeine

### **How the Test will Feel**

Electrodes (conductive patches) will be placed on your chest to record the heart's activity. The preparation of the electrode sites on your chest may produce a mild burning or stinging sensation. The blood pressure cuff on your arm will be inflated every few minutes. This produces a squeezing sensation that may feel tight. Baseline measurements of heart rate and blood pressure will be taken before exercise starts.

You will start walking on a treadmill or pedaling a stationary bicycle. The pace and incline of the treadmill (or the pedaling resistance) will slowly be increased.

Sometimes, people experience some of the following symptoms during the test:

- Chest discomfort
- Dizziness
- Palpitations
- Shortness of breath

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

Reasons why an exercise stress test may be performed include:

- You are having chest pain (to check for coronary artery disease, narrowing of the arteries that feed the heart muscle).
- Your angina is getting worse or is happening more often.
- You have had a heart attack.
- You have had angioplasty or heart bypass surgery.
- You are going to start an exercise program and you have heart disease or certain risk factors, such as diabetes.
- To identify heart rhythm changes that may occur during exercise.
- To further test for a heart valve problem (such as aortic valve or mitral valve stenosis).

There may be other reasons why your provider asks for this test.

### **Normal Results**

A normal test will most often mean that you were able to exercise as long as or longer than most people of your age and gender. You also did not have symptoms or concerning changes in blood pressure or your ECG.

The meaning of your test results depends on the reason for the test, your age, and your history of heart and other medical problems.

It may be hard to interpret the results of an exercise-only stress test in some people.

### **What Abnormal Results Mean**

Abnormal results may be due to:

- Abnormal heart rhythms during exercise
- Changes in your ECG that may mean there is a blockage in the arteries that supply your heart (coronary artery disease)

When you have an abnormal exercise stress test, you may have other tests performed on your heart such as:

- Cardiac catheterization
- Nuclear stress test

- Stress echocardiography

**Risks**

Stress tests are generally safe. Some people may have chest pain or may faint or collapse. A heart attack or dangerous irregular heart rhythm is rare.

People who are more likely to have such complications are often already known to have heart problems, so they are not given this test.

**Extraocular muscle function testing****Definition**

Extraocular muscle function testing examines the function of the eye muscles. A health care provider observes the movement of the eyes in six specific directions.

**Alternative Names**

EOM; Extraocular movement; Ocular motility examination

**How the Test is Performed**

You are asked to sit or stand with your head up and looking straight ahead. Your provider will hold a pen or other object about 16 inches or 40 centimeters (cm) in front of your face. The provider will then move the object in several directions and ask you to follow it with your eyes, without moving your head.

A test called a cover/uncover test may also be done. You will look at a distant object and the person doing the test will cover one eye, then after a few seconds, uncover it. You will be asked to keep looking at the distant object. How the eye moves after it is uncovered may show problems. Then the test is performed with the other eye.

A similar test called an alternate cover test may also be done. You will look at the same distant object and the person doing the test will cover one eye, and after a couple of seconds, shift the cover to the other eye. Then after a couple more seconds, shift it back to the first eye, and so on for 3 to 4 cycles. You will keep looking at the same object no matter which eye is covered.

**How to Prepare for the Test**

No special preparation is necessary for this test.

**How the Test will Feel**

The test involves only normal movement of the eyes.

**Why the Test is Performed**

This test is performed to evaluate weakness or other problems in the extraocular muscles. These problems may result in double vision or rapid, uncontrolled eye movements.

**Normal Results**

Normal movement of the eyes in all directions.

**What Abnormal Results Mean**

Eye movement disorders may be due to abnormalities of the muscles themselves. They may also be due to problems in the sections of the brain that control these muscles. Your provider will talk to you about any abnormalities that may be found.

**Risks**

There are no risks associated with this test.

**Considerations**

You may have a small amount of uncontrolled eye movement (nystagmus) when looking to an extreme left or right position. This is normal.

**Extremity angiography****Definition**

Extremity angiography is a test used to see the arteries in the hands, arms, feet, or legs. It is also called peripheral angiography.

Angiography uses x-rays and a special dye to see inside the arteries. Arteries are blood vessels that carry blood away from the heart.

**Alternative Names**

Angiography of the extremity; Peripheral angiography; Lower extremity angiogram; Peripheral angiogram; Arteriography of the extremity; PAD - angiography; Peripheral artery disease - angiography

**How the Test is Performed**



This test is done in a hospital. You will lie on an x-ray table. You may ask for some medicine to make you sleep and relax (sedative).

- The health care provider will shave and clean an area, most often in the groin.
- A numbing medicine (anesthetic) is injected into the skin over an artery.
- A needle is placed into that artery.
- A thin plastic tube called a catheter is passed through the needle into the artery. The doctor moves it into the area of the body being studied. The doctor can see live images of the area on a TV-like monitor, and uses them as a guide.
- Dye flows through the catheter and into the arteries.
- X-ray images are taken of the arteries.

Certain treatments can be done during this procedure. These treatments include:

- Dissolving a blood clot with medicine
- Opening a partially blocked artery with a balloon
- Placing a small tube called a stent into an artery to help hold it open

The health care team will check your pulse (heart rate), blood pressure, and breathing during the procedure.

The catheter is removed when the test is done. Pressure is placed on the area for 10 to 15 minutes to stop any bleeding. A bandage is then put on the wound.

The arm or leg where the needle was placed should be kept straight for 6 hours after the procedure. You should avoid strenuous activity, such as heavy lifting, for 24 to 48 hours.

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

You should not eat or drink anything for 6 to 8 hours before the test.

You may be told to stop taking certain medicines, such as aspirin or other blood thinners for a short while before the test. Never stop taking any medicines unless told to do so by your provider. Make sure your provider knows about all the medicines you take, including those you bought without a prescription. This includes herbs and supplements.

Tell your provider if you:

- Are pregnant
- Are allergic to any medicines
- Have ever had an allergic reaction to x-ray contrast material, shellfish, or iodine substances
- Have ever had any bleeding problems

### **How the Test will Feel**

The x-ray table is hard and cold. You may want to ask for a blanket or pillow. You may feel some stinging when the numbing medicine is injected. You may also feel some pressure as the catheter is moved.

The dye can cause a feeling of warmth and flushing. This is normal and most often goes away in a few seconds.

You may have tenderness and bruising at the site of the catheter insertion after the test. Seek immediate medical help if you have:

- Swelling
- Bleeding that doesn't go away
- Severe pain in an arm or leg

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

You may need this test if you have symptoms of a narrowed or blocked blood vessel in the arms, hands, legs, or feet.

The test may also be done to diagnose:

- Bleeding
- Swelling or inflammation of the blood vessels (vasculitis)

### **Normal Results**

The x-ray shows normal structures for your age.

### **What Abnormal Results Mean**

An abnormal result is commonly due to narrowing and hardening of the arteries in the arms or legs from plaque buildup (hardening of the arteries) in the artery walls.

The x-ray may show a blockage in the vessels caused by:

- Aneurysms (abnormal widening or ballooning of part of an artery)
- Blood clots
- Other diseases of the arteries

Abnormal results may also be due to:

- Inflammation of the blood vessels
- Injury to the blood vessels
- Thromboangiitis obliterans (Buerger disease)
- Takayasu disease

### **Risks**

Complications may include:

- Allergic reaction to the contrast dye
- Damage to the blood vessel as the needle and catheter are inserted
- Excessive bleeding or a blood clot where the catheter is inserted, which can reduce blood flow to the leg
- Heart attack or stroke
- Hematoma, a collection of blood at the site of the needle puncture
- Injury to the nerves at the needle puncture site
- Kidney damage from the dye
- Injury to the blood vessels being tested
- Limb loss from problems with the procedure

There is low-level radiation exposure. However, most experts feel that the risk for most x-rays is low compared with benefits. Pregnant women and children are more sensitive to the risks for the x-ray.

### **Extremity x-ray**

#### **Definition**

An extremity x-ray is an image of the hands, wrist, feet, ankle, leg, thigh, forearm humerus or upper arm, hip, shoulder or all of these areas. The term "extremity" often refers to a human limb. X-rays are a form of radiation that passes through the body to form an image on film. Structures that are dense (such as bone) will appear white. Air will be black, and other structures will be shades of gray.

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

The test is done in a hospital radiology department or in the health care provider's office. X-ray is done by an x-ray technologist.

You will need to hold still as the x-ray is taken. You may be asked to change position, so more x-rays can be taken.

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

Tell your provider if you are pregnant. Remove all jewelry from the area being imaged.

In general, there is no discomfort. You may be slightly uncomfortable while the leg or arm is put in place for the x-ray.

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

Your provider may order this test if you have signs of:

- A fracture
- Tumor
- Arthritis (inflammation of the joints)
- A foreign body (such as a piece of metal)

#### **Normal Results**

The x-ray shows normal structures for the age of the person.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- Bone conditions that get worse over time (degenerative)
- Bone tumor
- Broken bone (fracture)
- Dislocated bone
- Osteomyelitis (infection)
- Arthritis

Other conditions for which the test may be performed:

- Clubfoot
- To detect foreign objects in the body

### **Risks**

There is low-level radiation exposure. X-rays are monitored and regulated to provide the smallest amount of radiation exposure needed to make the image. Most experts feel that the risk is low compared with the benefits.

Pregnant women and children are more sensitive to the risks of an x-ray.

### **Eye and orbit ultrasound**

#### **Definition**

An eye and orbit ultrasound is a test to look at the eye area. It also measures the size and structures of the eye.

#### **Alternative Names**

Echography - eye orbit; Ultrasound - eye orbit; Ocular ultrasonography; Orbital ultrasonography

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

The test is most often done in the ophthalmologist's office or the ophthalmology department of a hospital or clinic.

Your eye is numbed with medicine (anesthetic drops). The ultrasound wand (transducer) is placed against the front surface of the eye.

The ultrasound uses high-frequency sound waves that travel through the eye. Reflections (echoes) of the sound waves form a picture of the structure of the eye. The test takes about 15 minutes.

There are 2 types of scans: A-scan and B-scan.

For the A-scan:

- You will most often sit in a chair and place your chin on a chin rest. You will look straight ahead.
- A small probe is placed against the front of your eye.
- The test may also be done with you lying back. With this method, a fluid-filled cup is placed against your eye to do the test.

For the B-scan:

- You will be seated and you may be asked to look in many directions. The test is most often done with your eyes closed.
- A gel is placed on the skin of your eyelids. The B-scan probe is gently placed against your eyelids to do the test.

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

No special preparation is needed for this test.

#### **How the Test will Feel**

Your eye is numbed, so you should not have any discomfort. You may be asked to look in different directions to improve the ultrasound image or so it can view different areas of your eye. The gel used with the B-scan may run down your cheek, but you will not feel any discomfort or pain.

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

You may need this test if you have cataracts or other eye problems.

An A-scan ultrasound measures the eye to determine the right power of a lens implant before cataract surgery.

A B-scan is done to look at the inside part of the eye or the space behind the eye that cannot be seen directly. This may occur when you have cataracts or other conditions that make it hard for the doctor to see into the back of your eye. The test may help diagnose retinal detachment, tumors, or other disorders.

#### **Normal Results**

For an A-scan, measurements of the eye are in the normal range.

For a B-scan, the structures of the eye and orbit appear normal.

#### **What Abnormal Results Mean**

A B-scan may show:

- Bleeding into the clear gel (vitreous) that fills the back of the eye (vitreous hemorrhage)

- Cancer of the retina (retinoblastoma), under the retina, or in other parts of the eye (such as melanoma)
- Damaged tissue or injuries in the bony socket (orbit) that surrounds and protects the eye
- Foreign bodies
- Pulling away of the retina from the back of the eye (retinal detachment)
- Swelling (inflammation)

### **Risks**

To avoid scratching the cornea, do not rub the numbed eye until the anesthetic wears off (about 15 minutes). There are no other risks.

### **Factor II (prothrombin) assay**

#### **Definition**

The factor II assay is a blood test to measure the activity of factor II. Factor II is also known as prothrombin. This is one of the proteins in the body that helps the blood clot.

#### **Alternative Names**

Prothrombin assay

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

A blood sample is needed.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is used to find the cause of too much bleeding (decreased blood clotting). This decreased clotting may be caused by an abnormally low level of factor II, a disorder called factor II deficiency.

#### **Normal Results**

The value should be 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Decreased factor II activity may be the result of:

- Deficiency of factor II
- Disorder in which the proteins that control blood clotting become over active (disseminated intravascular coagulation)
- Fat malabsorption (not enough fat absorbed in the diet)
- Liver disease (such as cirrhosis)
- Vitamin K deficiency
- Taking blood thinners

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often performed on people who have bleeding problems. The risk of excessive bleeding is slightly greater than for people without bleeding problems.

### **Factor IX assay**

#### **Definition**

The factor IX assay is a blood test that measures the activity of factor IX. This is one of the proteins in the body that helps the blood clot.

**Alternative Names**

Christmas factor assay; Serum factor IX; Hemophilic factor B; Plasma thromboplastin component; PTC

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

You may need to stop taking some medicines before this test. Your health care provider will tell you which ones.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

**Why the Test is Performed**

This test is used to find the cause of too much bleeding (decreased blood clotting). Or, it may be ordered if a family member is known to have hemophilia B. The test may also be done to see how well treatment for hemophilia B is working.

**Normal Results**

A normal value is 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

The examples above show the common measurements for results for these tests.

**What Abnormal Results Mean**

Decreased factor IX activity may be related to:

- Hemophilia B (a bleeding disorder caused by a lack of blood clotting factor IX)
- Disorder in which the proteins that control blood clotting become over active (disseminated intravascular coagulation)
- Fat malabsorption (not absorbing enough fat from your diet)
- Liver disease (such as cirrhosis)
- Vitamin K deficiency
- Taking blood thinners

**Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often done on people who have bleeding problems. The risk of excessive bleeding is slightly more than for people without bleeding problems

**Factor V assay****Definition**

The factor V (five) assay is a blood test to measure the activity of factor V. This is one of the proteins in the body that helps the blood clot.

**Alternative Names**

Labile factor; Proaccelerin; Ac-globulin

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

No special preparation is needed.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is used to find the cause of too much bleeding (decreased blood clotting). This decreased clotting may be caused by an abnormally low level of factor V.

### **Normal Results**

The value is normally 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your health care provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Decreased factor V activity may be related to:

- Factor V deficiency (a bleeding disorder that affects the ability of blood to clot)
- Disorder in which the proteins that control blood clotting become over active (disseminated intravascular coagulation)
- Liver disease (such as cirrhosis)
- Abnormal breakdown of blood clots (secondary fibrinolysis)

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often performed on people who have bleeding problems. The risk of excessive bleeding is slightly greater than for people without bleeding problems.

### **Factor VII assay**

#### **Definition**

The factor VII assay is a blood test to measure the activity of factor VII. This is one of the proteins in the body that helps the blood clot.

#### **Alternative Names**

Stable factor; Proconvertin; Autoprothrombin I

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

A blood sample is needed.

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

You may need to temporarily stop taking some medicines before this test. Your health care provider will tell you which ones.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is used to find the cause of abnormal bleeding (decreased blood clotting). This decreased clotting may be caused by an abnormally low level of factor VII.

### **Normal Results**

The normal value is 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Decreased factor VII activity may be related to:

- Factor VII deficiency (a bleeding disorder that affects the ability of blood to clot)



- Disorder in which the proteins that control blood clotting become over active (disseminated intravascular coagulation)
- Fat malabsorption (not absorbing enough fat from your diet)
- Liver disease (such as cirrhosis)
- Vitamin K deficiency
- Taking blood thinners

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often done on people who have bleeding problems. The risk of excessive bleeding is slightly greater than for people without bleeding problems.

### **Factor VIII assay**

#### **Definition**

The factor VIII assay is a blood test to measure the activity of factor VIII. This is one of the proteins in the body that helps the blood clot.

#### **Alternative Names**

Plasma factor VIII antigen; Antihemophilia factor; AHF

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

A blood sample is needed.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is used to find the cause of too much bleeding (decreased blood clotting). Or, it may be ordered if a family member is known to have hemophilia A. The test may also be done to see how well treatment for hemophilia A is working.

#### **Normal Results**

A normal value is 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your health care provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Decreased factor VIII activity may be due to:

- Hemophilia A (a bleeding disorder caused by a lack of blood clotting factor VIII)
- Disorder in which the proteins that control blood clotting become over active disseminated intravascular coagulation (DIC)
- Presence of a Factor VIII inhibitor (antibody)
- Von Willebrand disease (another type of bleeding disorder)

Increased activity may be due to:

- Older age
- Diabetes
- Liver disease
- Inflammation
- Pregnancy
- Obesity

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often done on people who have bleeding problems. The risk of too much bleeding is slightly greater for people with bleeding problems than others.

### **Factor X assay**

#### **Definition**

The factor X (ten) assay is a blood test to measure the activity of factor X. This is one of the proteins in the body that helps the blood clot.

#### **Alternative Names**

Stuart-Prower factor

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

A blood sample is needed.

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

You may need to stop taking some medicines before this test. Your health care provider will tell you which ones.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test may be used to find the cause of excessive bleeding (decreased blood clotting). The decreased clotting may be caused by an abnormally low level of factor X.

#### **Normal Results**

A normal value is 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Decreased factor X activity may be related to:

- Disorder in which abnormal proteins build up in tissues and organs (amyloidosis)
- Factor X deficiency (a bleeding disorder caused by a lack of blood clotting factor X)
- Disorder in which the proteins that control blood clotting become over active (disseminated intravascular coagulation)
- Fat malabsorption (not absorbing enough fat from your diet)
- Heparin use
- Liver disease
- Vitamin K deficiency
- Taking blood thinners

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often performed on people who have bleeding problems. The risk of excessive bleeding is slightly greater than for people without bleeding problems.

### **Factor XII assay**

#### **Definition**

The factor XII assay is a blood test to measure the activity of factor XII. This is one of the proteins in the body that helps the blood clot.

#### **Alternative Names**

Hageman factor assay

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

A blood sample is needed.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Your health care provider may want you to have this test if you had abnormal results on the partial thromboplastin time (PTT) blood-clotting test. You may also need the test if a family member is known to have factor XII deficiency.

#### **Normal Results**

A normal value is 50% to 200% of the laboratory control or reference value.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different samples. Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Decreased factor XII activity may indicate:

- Factor XII deficiency (a bleeding disorder caused by a lack of blood clotting factor XII)
- Liver disease

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

### **Fecal culture**

#### **Definition**

A fecal culture is a lab test to find organisms in the stool (feces) that can cause gastrointestinal symptoms and disease.

#### **Alternative Names**

Stool culture; Culture - stool; Gastroenteritis fecal culture

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

A stool sample is needed.

There are many ways to collect the sample.

You can collect the sample:

- On plastic wrap. Place the wrap loosely over the toilet bowl so that it is held in place by the toilet seat. Put the sample in a clean container given to you by your health care provider.
- In a test kit that supplies a special toilet tissue. Put it in a clean container given to you by your provider.

Do not mix urine, water, or toilet tissue with the sample.

For children wearing diapers:

- Line the diaper with plastic wrap.
- Position the plastic wrap so that it will prevent urine and stool from mixing. This will provide a better sample.

Return the sample to the laboratory as soon as possible. Do not include toilet paper or urine in the specimen.

In the lab, a technician places a sample of the specimen in a special dish. The dish is then filled with a gel that boosts the growth of bacteria or other germs. If there is growth, the germs are identified. The lab technician may also do more tests to determine the best treatment.

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

You will get a collection container for the stool specimen.

#### **How the Test will Feel**

There is no discomfort.

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

The test is performed when your health care provider suspects that you may have a gastrointestinal infection. It may be done if you have severe diarrhea that does not go away or that keeps coming back.

#### **Normal Results**

There are no abnormal bacteria or other organisms in the sample.

Talk to your provider about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may mean you have an intestinal infection.

#### **Risks**

There are no risks.

#### **Considerations**

Often other stool tests are done in addition to the culture, such as:

- Gram stain of stool
- Fecal smear
- Stool ova and parasites exam

#### **Fecal fat**

##### **Definition**

The fecal fat test measures the amount of fat in the stool. This can help gauge the percentage of dietary fat that the body does not absorb.

##### **Alternative Names**

Quantitative stool fat determination; Fat absorption

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

There are many ways to collect the samples.

- For adults and children, you can catch the stool on plastic wrap that is loosely placed over the toilet bowl and held in place by the toilet seat. Then put the sample in a clean container. One test kit supplies a special toilet tissue that you use to collect the sample, then put the sample in a clean container.
- For infants and children wearing diapers, you can line the diaper with plastic wrap. If the plastic wrap is placed properly, you can prevent mixing of urine and stool. This will provide a better sample.

Collect all stool that is released over a 24-hour period (or sometimes 3 days) in the containers provided. Label the containers with name, time, and date, and send them to the lab.

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

Eat a normal diet containing about 100 grams (g) of fat per day for 3 days before starting the test. The health care provider may ask you to stop using drugs or food additives that could affect the test.

##### **How the Test will Feel**

The test involves only normal bowel movements. There is no discomfort.

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

This test evaluates fat absorption to tell how well the liver, gallbladder, pancreas, and intestines are working.

Fat malabsorption can cause a change in your stools called steatorrhea. To absorb fat normally, the body needs bile from the gallbladder (or liver if the gallbladder has been removed), enzymes from the pancreas, and a normal small intestine.

### **Normal Results**

Less than 7 g of fat per 24 hours.

### **What Abnormal Results Mean**

Decreased fat absorption may be caused by:

- Biliary tumor
- Biliary stricture
- Celiac disease
- Chronic pancreatitis
- Crohn disease
- Cystic fibrosis
- Gallstones (cholelithiasis)
- Pancreatic cancer
- Pancreatitis
- Radiation enteritis
- Short bowel syndrome (for example from surgery or an inherited problem)
- Sprue
- Whipple disease
- Small bowel bacterial overgrowth

### **Risks**

There are no risks.

### **Considerations**

Factors that interfere with the test are:

- Enemas
- Laxatives
- Mineral oil
- Inadequate fat in diet prior to and during the stool collection

### **Fecal smear**

#### **Definition**

Fecal smear is a laboratory test of a stool sample. This test is done to check for bacteria and other organisms. Presence of organisms in stool shows diseases in the digestive tract.

#### **Alternative Names**

Stool smear

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

A stool sample is needed.

There are many ways to collect the sample. You can collect the sample:

- On plastic wrap: Place the wrap loosely over the toilet bowl so that it is held in place by the toilet seat. Put the sample in a clean container given to you by your health care provider.
- In a test kit that supplies a special toilet tissue: Put the sample in a clean container given to you by your provider.

Do not mix urine, water, or toilet tissue with the sample.

For children wearing diapers:

- Line the diaper with plastic wrap.
- Position the plastic wrap so that it will prevent urine and stool from mixing. This will provide a better sample.
- Put the sample in a container given to you by your provider.

Make sure you follow your provider's instructions for returning the sample. Return the sample to the lab as soon as possible.

The stool sample is sent to a lab where a small amount is placed on a slide. The slide is placed under a microscope and checked for the presence of bacteria, fungi, parasites, or viruses. A stain may be placed on the sample that highlights certain germs under the microscope.

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

There is no preparation needed.

**How the Test will Feel**

There is no discomfort.

**Why the Test is Performed**

Your provider may order this test if you have severe diarrhea that will not go away or that keeps returning. The test result may be used to select the correct antibiotic treatment.

**Normal Results**

A normal result means there are no disease-causing germs present.

Normal value ranges may vary slightly among different labs. Talk to your provider about the meaning of your test results.

**What Abnormal Results Mean**

An abnormal result means that abnormal germs have been found in the stool sample. This may be due to an infection of the digestive tract.

**Risks**

There are no risks associated with a fecal smear.

**Ferritin blood test****Definition**

The ferritin blood test measures the level of ferritin in the blood.

Ferritin is a protein inside your cells that stores iron. It allows your body to use the iron when it needs it. A ferritin test indirectly measures the amount of iron in your blood.

**Alternative Names**

Serum ferritin level; Iron deficiency anemia - ferritin

**How the Test is Performed**

A blood sample is needed.

**How to Prepare for the Test**

Your health care provider may tell you not to eat anything (to fast) for 12 hours before the test. You may also be told to have the test done in the morning.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

The amount of ferritin in the blood (serum ferritin level) is directly related to the amount of iron stored in your body. Iron is needed to make healthy red blood cells. These cells carry oxygen to body tissues.

Your provider may recommend this test if you have signs or symptoms of anemia due to low iron. Anemia is a condition in which the body does not have enough healthy red blood cells.

**Normal Results**

Normal value range is:

- Male: 12 to 300 nanograms per milliliter (ng/mL)
- Female: 12 to 150 ng/mL

The lower the ferritin level, even within the "normal" range, the more likely it is that the person does not have enough iron.

The number ranges above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your provider about the meaning of your specific results.

**What Abnormal Results Mean**

A higher-than-normal ferritin level may be due to:

- Liver disease due to alcohol abuse
- Any autoimmune disorder, such as rheumatoid arthritis
- Frequent transfusion of red blood cells
- Too much iron in the body (hemochromatosis)

A lower-than-normal level of ferritin occurs if you have anemia caused by low iron levels in the body. This type of anemia may be due to:

- A diet too low in iron
- Heavy bleeding from an injury



- Heavy menstrual bleeding
- Poor absorption of iron from food, medicines, or vitamins
- Bleeding in the esophagus, stomach, or intestines

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Risks of having blood drawn are slight, but may include:

- Excessive bleeding
- Multiple punctures to locate veins
- Fainting or feeling lightheaded
- Blood accumulating under the skin (hematoma)
- Infection (a slight risk any time the skin is broken)

### **Fetal echocardiography**

#### **Definition**

Fetal echocardiography is a test that uses sound waves (ultrasound) to evaluate the baby's heart for problems before birth.

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

Fetal echocardiography is a test that is done while the baby is still in the womb. It is most often done during the second trimester of pregnancy. This is when a woman is about 18 to 24 weeks pregnant.

The procedure is similar to that of a pregnancy ultrasound. You will lie down for the procedure. The test can be performed on your belly (abdominal ultrasound) or through your vagina (transvaginal ultrasound).

In an abdominal ultrasound, the person performing the test places a clear, water-based gel on your belly. A hand-held probe is moved over the area. The probe sends out sound waves, which bounce off the baby's heart and create a picture of the heart on a computer screen.

In a transvaginal ultrasound, a much smaller probe is placed into the vagina. A transvaginal ultrasound can be done earlier in the pregnancy and produces a clearer image than an abdominal ultrasound.

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

No special preparation is needed for this test.

#### **How the Test will Feel**

The conducting gel may feel slightly cold and wet. You will not feel the ultrasound waves.

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

This test is done to detect a heart problem before the baby is born. It can provide a more detailed image of the baby's heart than a regular pregnancy ultrasound.

The test can show:

- Blood flow through the heart
- Heart rhythm
- Structures of the baby's heart

The test may be done if:

- A parent, sibling or other close family member had a heart defect or heart disease.
- A routine pregnancy ultrasound detected an abnormal heart rhythm or possible heart problem in the unborn baby.
- The mother has diabetes (prior to pregnancy), lupus, or phenylketonuria.
- The mother has rubella during the first trimester of pregnancy.
- The mother has used medicines that can damage the baby's developing heart (such as some epilepsy drugs and prescription acne medicines).
- An amniocentesis revealed a chromosome disorder.
- There is some other reason to suspect that the baby is at higher risk for heart problems.

#### **Normal Results**

The echocardiogram finds no problems in the unborn baby's heart.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- A problem in the way the baby's heart has formed (congenital heart disease)
- A problem with the way the baby's heart works
- Heart rhythm disturbances (arrhythmias)

The test may need to be repeated.

### **Risks**

There are no known risks to the mother or unborn baby.

### **Considerations**

Some heart defects cannot be seen before birth, even with fetal echocardiography. These include small holes in the heart or mild valve problems. Also, because it may not be possible to see every part of the large blood vessels leading out of the baby's heart, problems in this area may go undetected.

If the health care provider finds a problem in the structure of the heart, a detailed ultrasound may be done to look for other problems with the developing baby.

### **Fetal MRI**

Magnetic Resonance Imaging (MRI) is a well-established diagnostic imaging technique that uses a strong magnetic field and radio waves to obtain pictures of the inside of the body without utilizing radiation. The MRI machine acquires data regarding the fetus without causing harm and creates detailed images in different angles that radiologists and other members of the Fetal Medicine team can view. From the published literature, it would appear that MRI provides additional diagnostic information to that given by ultrasound in nearly half of the cases, which in turn may have influence on prenatal counseling and/or management of affected pregnancies.

### **How a fetal MRI Is performed**

The MRI scanner can be described as a big box with a tunnel through the middle. You will lay in the MRI tunnel either on your back, or if this is uncomfortable, as it is often in advanced pregnancies, on your left or right side. (If on your back, padding behind the knees helps take pressure of the lower back.)

You will need to be as still as possible during the MRI because motion degrades the images. Foam cushions and soft straps can be used to help keep you still. A soft, flexible wrap goes over the belly and records the radio waves for the picture creation. You will be asked to empty your bladder prior to the MRI. Patients often benefit from having a companion in the room. Earplugs are worn to mute the loud knocking noise of the machine. There is an intercom in the scanner, so you can talk to the MRI technologist performing the scan.

### **MRI is Safe**

The present data shows that the magnetic field and the radio waves that are used in the MRI are safe for the mother and the unborn baby. The MRI has been used for more than 15 years without a reported negative effect on the imaged fetuses. Therefore, pregnant patients can be accepted to undergo MRI scans at any stage of pregnancy, but are preferably weeks of gestation.

### **Special Precautions**

All people entering the MRI room are required to complete a MRI questionnaire prior to the scan. It asks the patient's medical history and helps the MRI team ensure the safety of all patients in the scanning room. Because the machine is a large magnet, no metal can be brought into the room. All body piercings must be removed. The following items are affected by the magnet and are not permitted into the scanning room for safety reasons: watches, pens, keys, hair pins, safety pins, mobile phones, credit cards, pagers, radios, and CD players.

### **Scheduling Your MRI**

Your obstetrician or perinatologist will send a referral to Children's Hospital Oakland. Our radiologists will then decide when to schedule your test. The schedulers in Diagnostic Imaging will contact you with the day and time for your test. The Fetal Medicine Nurse Practitioner will call you prior to your appointment to give you more information about what to expect and answer any questions.

### **Getting the Results**

The MRI exam findings will be reported by the radiologist as early as possible, but sometimes results can take up to 24–48 hours. Naturally, in complex cases the image analysis may require more time, as the radiologist needs to consult and discuss the findings for the most accurate interpretation with the other radiologists on our team. The report will be delivered to the ordering

physician. The radiologist will also be in contact with your OB/GYN or perinatologist and send them a copy of the MRI findings. The doctor who ordered your Fetal MRI will give you the final results.

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### **Fetal scalp pH testing**

#### **Definition**

Fetal scalp pH testing is a procedure performed when a woman is in active labor to determine if the baby is getting enough oxygen.

#### **Alternative Names**

Fetal scalp blood; Scalp pH testing; Fetal blood testing - scalp; Fetal distress - fetal scalp testing; Labor - fetal scalp testing

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

The procedure takes about 5 minutes. The mother lies on her back with her feet in stirrups. If her cervix is dilated at least 3 to 4 centimeters, a plastic cone is placed in the vagina and fit snugly against the scalp of the fetus.

The scalp of the fetus is cleansed and a small blood sample is taken for examination. The blood is collected in a thin tube. The tube is either sent to the hospital laboratory or analyzed by a machine in the labor and delivery department. In either case, results are available in just a few minutes. If the woman's cervix is not dilated enough, the test cannot be done.

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

The health care provider will explain the procedure and its risks. There isn't always a separate consent form for this procedure because many hospitals consider it part of the general consent form you signed at admission.

#### **How the Test will Feel**

The procedure should feel like a long pelvic exam. At this stage of labor, many women have already had epidural anesthesia and may not feel the pressure of the procedure at all.

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

Sometimes fetal heart monitoring doesn't provide enough information about the well-being of a baby. In these cases, testing the scalp pH can help the doctor decide whether the fetus is getting enough oxygen during labor. This helps determine whether the baby is healthy enough to continue labor, or if a forceps delivery or cesarean birth might be the best route of delivery.

Although the test is not uncommon, most deliveries do not involve fetal scalp pH testing.

This test is not recommended for mothers with infections such as HIV/AIDS or hepatitis C.

#### **Normal Results**

Normal fetal blood sample results are:

- Normal pH: 7.25 to 7.35
- Borderline pH: 7.20 to 7.25

The examples above are common measurements for results of these tests. Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

A fetal scalp blood pH level of less than 7.20 is considered abnormal.

In general, low pH suggests that the baby does not have enough oxygen. This may mean that the baby is not tolerating labor very well. The results of a fetal scalp pH sample need to be interpreted for each labor. The provider may feel that the results mean the baby needs to be delivered quickly, either by forceps or by C-section.

Fetal scalp pH testing may need to be repeated a few times during a complicated labor to keep checking on the baby.

### **Risks**

Risks include the following:

- Continued bleeding from the puncture site (more likely if the fetus has a pH imbalance)
- Infection
- Bruising of the baby's scalp

### **Fetal-maternal erythrocyte distribution blood test**

#### **Definition**

The fetal-maternal erythrocyte distribution test is used to measure the number of the unborn baby's red blood cells in a pregnant woman's blood.

#### **Alternative Names**

Kleihauer-Betke stain; Flow cytometry - fetal-maternal erythrocyte distribution; Rh incompatibility - erythrocyte distribution

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

A blood sample is needed.

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

No special preparation is necessary for this test.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Rh incompatibility is a condition that occurs when the mother's blood type is Rh-negative (Rh-) and her unborn baby's blood type is Rh-positive (Rh+). If the mother is Rh+, or if both parents are Rh-, there is no reason to worry about Rh incompatibility.

If the baby's blood is Rh+ and gets into the mother's Rh- bloodstream, her body will produce antibodies. These antibodies could pass back through the placenta and harm the developing baby's red blood cells. This can cause mild to serious anemia in the unborn baby.

This test determines the amount of blood that has been exchanged between the mother and fetus.

All Rh- pregnant women should get this test if they have bleeding or a risk of bleeding during the pregnancy.

In a woman whose blood is Rh incompatible with her infant, this test helps find out how much Rh immune globulin (RhoGAM) she must receive to prevent her body from producing abnormal proteins that attack the unborn baby in future pregnancies.

#### **Normal Results**

In a normal value, no or few of the baby's cells are in the mother's blood. The standard dose of RhoGAM is enough in this case.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

In an abnormal test result, blood from the unborn baby is leaking into the mother's blood circulation. The more of the baby's cells there are, the more Rh immune globulin the mother must receive.

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

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

- Excessive bleeding
- Multiple punctures to locate veins
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Fibrin degradation products blood test**

### **Definition**

Fibrin degradation products (FDPs) are the substances left behind when clots dissolve in the blood. A blood test can be done to measure these products.

### **Alternative Names**

FDPs; FSPs; Fibrin split products; Fibrin breakdown products

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

A blood sample is needed.

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

Certain medicines can change blood test results.

- Tell your health care provider about all the medicines you take.
- Your provider will tell you if you need to temporarily stop taking any medicines before you have this test. This includes blood thinners such as aspirin, heparin, streptokinase, and urokinase, which make it hard for the blood to clot.
- Do not stop or change your medicines without talking to your provider first.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

This test is done to see if your clot-dissolving (fibrinolytic) system is working properly. Your provider may order this test if you have signs of disseminated intravascular coagulation (DIC) or another clot-dissolving disorder.

### **Normal Results**

The result is normally less than 10 mcg/mL (10 mg/L).

Note: Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

### **What Abnormal Results Mean**

Increased FDPs may be a sign of primary or secondary fibrinolysis (clot-dissolving activity) due to a variety of causes, including:

- Blood clotting problems
- Burns
- Problem with the heart's structure and function that is present at birth (congenital heart disease)
- Disseminated intravascular coagulation (DIC)
- Low level of oxygen in the blood
- Infections
- Leukemia
- Liver disease
- Problem during pregnancy such as preeclampsia, placenta abruptio, miscarriage
- Recent blood transfusion
- Recent surgery that involved a heart and lung bypass pump, or surgery to lower high blood pressure in the liver
- Kidney disease
- Transplant rejection
- Transfusion reaction

### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 with having blood drawn are slight, but may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)

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

### **Fibrinogen blood test**

#### **Definition**

Fibrinogen is a protein produced by the liver. This protein helps stop bleeding by helping blood clots to form. A blood test can be done to tell how much fibrinogen you have in the blood.

#### **Alternative Names**

Serum fibrinogen; Plasma fibrinogen; Factor I; Hypofibrinogenemia test

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

A sample of blood is needed.

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

No special preparation is needed.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

Your doctor may order this test if you have problems with blood clotting, such as excessive bleeding.

#### **Normal Results**

The normal range is 200 to 400 mg/dL (2.0 to 4.0 g/L).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

#### **What Abnormal Results Mean**

Abnormal results may be due to:

- The body using up too much fibrinogen, such as in disseminated intravascular coagulation (DIC)
- Fibrinogen deficiency (from birth, or acquired after birth)
- Breakdown of fibrin (fibrinolysis)
- Too much bleeding (hemorrhage)

The test may also be performed during pregnancy if the placenta separates from its attachment to the uterus wall (placenta abruption).

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

This test is most often performed on people who have bleeding disorders. The risk for excessive bleeding is slightly greater in such people than it is for those who do not have bleeding problems.

### **Fibrinopeptide A blood test**

#### **Definition**

Fibrinopeptide A is a substance released as blood clots in your body. A test can be done to measure the level of this substance in your blood.

#### **Alternative Names**

FPA

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

A blood sample is needed.

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

No special preparation is necessary.

#### **How the Test will Feel**



When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

This test is used to help diagnose severe problems with blood clotting, such as disseminated intravascular coagulation (DIC). Certain types of leukemia are associated with DIC.

### **Normal Results**

In general, the level of fibrinopeptide A should range from 0.6 to 1.9 (mg/mL).

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or may test different specimens. Talk to your doctor about the meaning of your specific test results.

### **What Abnormal Results Mean**

An increased fibrinopeptide A level may be a sign of:

- Cellulitis
- DIC (disseminated intravascular coagulation)
- Leukemia at the time of diagnosis, during early treatment, and during a relapse
- Some infections
- Systemic lupus erythematosus (SLE)

### **Risks**

There is little risk in having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Drawing blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Fine needle aspiration of the thyroid**

### **Definition**

Fine needle aspiration of the thyroid gland is a procedure to remove thyroid cells for examination. The thyroid gland is a butterfly-shaped gland located inside the front of the lower neck.

### **Alternative Names**

Thyroid nodule fine needle aspirate biopsy; Biopsy - thyroid - skinny-needle; Skinny-needle thyroid biopsy; Thyroid nodule - aspiration; Thyroid cancer - aspiration

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

This test may be done in the health care provider's office or in a hospital. Numbing medicine (anesthesia) may or may not be used. Because the needle is very thin, you may not need this medicine.

You lie on your back with a pillow under your shoulders with your neck extended. The biopsy site is cleaned. A thin needle is inserted into your thyroid, where it collects a sample of thyroid cells and fluid. The needle is then taken out. If the provider cannot feel the biopsy site, they may use ultrasound or a CT scan to guide where to put the needle. Ultrasound and CT scans are painless procedures that show images inside the body.

Pressure is applied to the biopsy site to stop any bleeding. The site is then covered with a bandage.

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

Tell your provider if you have drug allergies, bleeding problems, or are pregnant. Also, make sure your provider has a current list of all medicines you take, including herbal remedies and over-the-counter drugs.

A few days to a week before your biopsy, you may be asked to temporarily stop taking blood-thinning medicines. The drugs you may need to stop taking include:

- Aspirin
- Clopidogrel (Plavix)
- Ibuprofen (Advil, Motrin)
- Naproxen (Aleve, Naprosyn)
- Warfarin (Coumadin)

Be sure to talk with your provider before stopping any drugs.

**How the Test will Feel**

If numbing medicine is used, you may feel a sting as the needle is inserted and the medicine is injected.

As the biopsy needle passes into your thyroid, you may feel some pressure, but it should not be painful.

You may have slight discomfort in your neck afterward. You may also have slight bruising, which soon goes away.

**Why the Test is Performed**

This is a test to diagnose thyroid disease or thyroid cancer. It is often used to find out if thyroid nodules that your provider can feel or seen on an ultrasound are noncancerous or cancerous.

**Normal Results**

A normal result shows the thyroid tissue looks normal and the cells do not appear to be cancer under a microscope.

**What Abnormal Results Mean**

Abnormal results may mean:

- Thyroid disease, such as goiter or thyroiditis
- Noncancerous tumors
- Thyroid cancer

**Risks**

The main risk is bleeding into or around the thyroid gland. With severe bleeding, there may be pressure on the windpipe (trachea). This problem is rare.

**Fluorescein angiography****Definition**

Fluorescein angiography is an eye test that uses a special dye and camera to look at blood flow in the retina and choroid. These are the two layers in the back of the eye.

**Alternative Names**

Retinal photography; Eye angiography; Angiography - fluorescein

**How the Test is Performed**

You will be given eye drops that make your pupil dilate. You will be asked to place your chin on a chin rest and your forehead against a support bar to keep your head still during the test.

The health care provider will take pictures of the inside of your eye. After the first group of pictures is taken, a dye called fluorescein is injected into a vein. Most often it is injected at the inside of your elbow. A camera-like device takes pictures as the dye moves through the blood vessels in the back of your eye.

A newer method called ultra-widefield fluorescein angiography can provide more information about certain diseases than regular angiography.

**How to Prepare for the Test**

You will need someone to drive you home. Your vision may be blurry for up to 12 hours after the test.

You may be told to stop taking medicines that could affect the test results. Tell your provider about any allergies, particularly reactions to iodine.

You must sign an informed consent form. You must remove contact lenses before the test.

Tell the provider if you may be pregnant.

**How the Test will Feel**

When the needle is inserted, some people feel slight pain. Others feel only a prick or sting. Afterward, there may be some throbbing.

When the dye is injected, you may have mild nausea and a warm feeling in your body. These symptoms go away quickly most of the time.

The dye will cause your urine to be darker. It may be orange in color for a day or two after the test.

**Why the Test is Performed**

This test is done to see if there is proper blood flow in the blood vessels in the two layers in the back of your eye (the retina and choroid).

It can also be used to diagnose problems in the eye or to determine how well certain eye treatments are working.

### **Normal Results**

A normal result means the vessels appear a normal size, there are no new abnormal vessels, and there are no blockages or leakages.

### **What Abnormal Results Mean**

If blockage or leakage is present, the pictures will map the location for possible treatment.

An abnormal value on a fluorescein angiography may be due to:

- Blood flow (circulatory) problems, such as blockage of the arteries or veins
- Cancer
- Diabetic or other retinopathy
- High blood pressure
- Inflammation or edema
- Macular degeneration
- Microaneurysms -- enlargement of capillaries in the retina
- Tumors
- Swelling of the optic disc

The test may also be done if you have:

- Retinal detachment
- Retinitis pigmentosa

### **Risks**

There is a slight chance of infection any time the skin is broken. Rarely, a person is overly sensitive to the dye and may experience:

- Dizziness or faintness
- Dry mouth or increased salivation
- Hives
- Increased heart rate
- Metallic taste in mouth
- Nausea and vomiting
- Sneezing

Serious allergic reactions are rare.

### **Considerations**

The test results are harder to interpret in people with cataracts.

### **Fluorescein eye stain**

#### **Definition**

This is a test that uses orange dye (fluorescein) and a blue light to detect foreign bodies in the eye. This test can also detect damage to the cornea. The cornea is the outer surface of the eye.

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

A piece of blotting paper containing the dye is touched to the surface of your eye. You are asked to blink. Blinking spreads the dye and coats the tear film covering the surface of the cornea. The tear film contains water, oil, and mucus to protect and lubricate the eye.

The health care provider then shines a blue light at your eye. Any problems on the surface of the cornea will be stained by the dye and appear green under the blue light.

The provider can determine the location and likely cause of the cornea problem depending on the size, location, and shape of the staining.

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

You will need to remove your eyeglasses or contact lenses before the test.

#### **How the Test will Feel**

If your eyes are very dry, the blotting paper may be slightly scratchy. The dye may cause a mild and brief stinging sensation.

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

This test is to:

- Find scratches or other problems with the surface of the cornea
- Reveal foreign bodies on the eye surface
- Determine if there is irritation of the cornea after contacts are prescribed

### **Normal Results**

If the test result is normal, the dye remains in the tear film on the surface of the eye and does not stick to the eye itself.

### **What Abnormal Results Mean**

Abnormal results may point to:

- Abnormal tear production (dry eye)
- Blocked tear duct
- Corneal abrasion (a scratch on the surface of the cornea)
- Foreign bodies, such as eyelashes or dust (foreign object in eye)
- Infection
- Injury or trauma
- Severe dry eye associated with arthritis (keratoconjunctivitis sicca)

### **Risks**

If the dye touches the skin, there may be a slight, brief, discoloration.

### **Flushable reagent stool blood test**

#### **Definition**

Flushable reagent stool blood test is an at-home test to detect hidden blood in the stool.

#### **Alternative Names**

Stool occult blood test - flushable home test; Fecal occult blood test - flushable home test

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

This test is performed at home with disposable pads. You can buy the pads at the drug store without a prescription. Brand names include EZ-Detect, HomeChek Reveal, and ColoCARE.

You do not handle stool directly with this test. You simply note any changes you see on a card and then mail the results card to your health care provider.

To do the test:

- Urinate if you need to, then flush the toilet before having a bowel movement.
- After the bowel movement, place the disposable pad in the toilet.
- Watch for a change of color on the test area of the pad. Results will appear in about 2 minutes.
- Note the results on the card provided, then flush the pad away.
- Repeat for the next two bowel movements.

The different tests use different ways to check for water quality. Check the package for instructions.

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

Some medicines may interfere with this test.

Check with your provider about changes in your medicines you may need to make. Never stop taking a medicine or change how you take it without first talking to your provider.

Check test package to see if there are any foods you need to stop eating before doing the test.

#### **How the Test will Feel**

This test involves only normal bowel functions, and there is no discomfort.

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

This test is mainly performed for colorectal cancer screening. It may also be done in the case of low levels of red blood cells (anemia).

### **Normal Results**

A negative result is normal. It means you have no evidence of gastrointestinal bleeding.

Normal value ranges may vary slightly among different labs. Talk to your provider about your test results.

### **What Abnormal Results Mean**

Abnormal results of the flushable pad mean there is bleeding present somewhere in the digestive tract, which may be caused by:

- Swollen, fragile blood vessels in the colon that may result in blood loss
- Colon cancer
- Colon polyps
- Enlarged veins, called varices, in the walls of the esophagus (the tube that connects your throat to your stomach) that bleed

- When the lining of the stomach or the esophagus becomes inflamed or swollen
- Infections in the stomach and intestines
- Hemorrhoids
- Crohn disease or ulcerative colitis
- Ulcer in the stomach or first part of the intestines

Other causes of a positive test, which do not indicate a problem in the gastrointestinal tract, include:

- Coughing up and then swallowing blood
- Nose bleed

Abnormal test results require follow-up with your doctor.

### **Risks**

The test can have false-positive (the test indicates a problem when there actually is none) or false-negative (the test indicates there is NOT a problem, but there is) results. This is similar to other stool smear tests which can also give false results.

### **Folic acid - test**

#### **Definition**

Folic acid is a type of B vitamin. This article discusses the test to measure the amount of folic acid in the blood.

#### **Alternative Names**

Folate - test

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

A blood sample is needed.

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

You should not eat or drink for 6 hours before the test. Your health care provider may tell you to stop taking any drugs that may interfere with test results, including folic acid supplements.

Drugs that can decrease folic acid measurements include:

- Alcohol
- Aminosalicic acid
- Birth control pills
- Estrogens
- Tetracyclines
- Ampicillin
- Chloramphenicol
- Erythromycin
- Methotrexate
- Penicillin
- Aminopterin
- Phenobarbital
- Phenytoin
- Drugs to treat malaria

#### **How the Test will Feel**

You may feel slight pain or a little sting when the needle is inserted. There may be some throbbing at the site.

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

This test is done to check for folic acid deficiency.

Folic acid helps form red blood cells and produce DNA that stores genetic codes. Taking the right amount of folic acid before and during pregnancy helps prevent neural tube defects, such as spina bifida.

Women who are pregnant or planning to become pregnant should take at least 600 micrograms (mcg) of folic acid every day. Some women may need to take more if they have a history of neural tube defects in earlier pregnancies. Ask your provider how much you need.

#### **Normal Results**

The normal range is 2.7 to 17.0 nanograms per milliliter (ng/mL) or 6.12 to 38.52 nanomoles per liter (nmol/L).

Normal value ranges may vary slightly among different labs. Talk to your provider about the meaning of your test results.

The examples above show the common measurements for results for these tests. Some labs use different measurements or may test different specimens.

### **What Abnormal Results Mean**

Lower-than-normal folic acid levels may indicate:

- Poor diet
- Malabsorption syndrome (for example, celiac sprue)
- Malnutrition

The test may also be done in cases of:

- Anemia due to folate deficiency
- Megaloblastic anemia

### **Risks**

There is very little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Other slight risks from having blood drawn may include:

- Excessive bleeding
- Fainting or feeling lightheaded
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

## **Follicle-stimulating hormone (FSH) blood test**

### **Definition**

The follicle stimulating hormone (FSH) blood test measures the level of FSH in blood. FSH is a hormone released by the pituitary gland, located on the underside of the brain.

### **Alternative Names**

Follicle stimulating hormone; Menopause - FSH; Vaginal bleeding - FSH

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

A blood sample is needed.

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

If you are a woman of childbearing age, your health care provider may want you to have the test done on certain days of your menstrual cycle.

### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

In women, FSH helps manage the menstrual cycle and stimulates the ovaries to produce eggs. The test is used to help diagnose or evaluate:

- Menopause
- Women who have polycystic ovary syndrome, ovarian cysts
- Abnormal vaginal or menstrual bleeding
- Problems becoming pregnant, or infertility

In men, FSH stimulates production of sperm. The test is used to help diagnose or evaluate:

- Problems becoming pregnant, or infertility
- Men who do not have testicles or whose testicles are underdeveloped

In children, FSH is involved with the development of sexual features. The test is ordered for children:

- Who develop sexual features at a very young age
- Who are delayed in starting puberty

### **Normal Results**

Normal FSH levels will differ, depending on a person's age and sex.

Male:

- Before puberty - 0 to 5.0 mIU/mL (0 to 5.0 IU/L)
- During puberty - 0.3 to 10.0 mIU/mL (0.3 to 10.0 IU/L)
- Adult - 1.5 to 12.4 mIU/mL (1.5 to 12.4 IU/L)



Female:

- Before puberty - 0 to 4.0 mIU/mL (0 to 4.0 IU/L)
- During puberty - 0.3 to 10.0 mIU/mL (0.3 to 10.0 IU/L)
- Women who are still menstruating - 4.7 to 21.5 mIU/mL (4.5 to 21.5 IU/L)
- After menopause - 25.8 to 134.8 mIU/mL (25.8 to 134.8 IU/L)

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your doctor about the meaning of your specific test result.

#### **What Abnormal Results Mean**

High FSH levels in women may be present:

- During or after menopause, including premature menopause
- When receiving hormone therapy
- Due to certain types of tumor in the pituitary gland
- Due to Turner syndrome

Low FSH levels in women may be present due to:

- Being very underweight or having had recent rapid weight loss
- Not producing eggs (not ovulating)
- Parts of the brain (the pituitary gland or hypothalamus) not producing normal amounts of some or all of its hormones
- Pregnancy

High FSH levels in men may mean the testicles are not functioning correctly due to:

- Advancing age (male menopause)
- Damage to testicles caused by alcohol abuse, chemotherapy, or radiation
- Problems with genes, such as Klinefelter syndrome
- Treatment with hormones
- Certain tumors in the pituitary gland

Low FSH levels in men may mean parts of the brain (the pituitary gland or hypothalamus) do not produce normal amounts of some or all of its hormones.

High FSH levels in boys or girls may mean that puberty is about to start.

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)

#### **Foot drop**

##### **Definition**

Foot drop is when you have difficulty lifting the front part of your foot. This may cause you to drag your foot when you walk. Foot drop, also called drop foot, can be caused by a problem with the muscles, nerves, or anatomy of your foot or leg.

##### **Alternative Names**

Peroneal nerve injury - foot drop; Foot drop palsy; Peroneal neuropathy; Drop foot

##### **Causes**

Foot drop is not a condition by itself. It is a symptom of another disorder. Foot drop can be caused by a number of health conditions.

The most common cause of foot drop is peroneal nerve injury. The peroneal nerve is a branch of the sciatic nerve. It supplies movement and sensation to the lower leg, foot, and toes.

Conditions that affect the nerves and muscles in the body can lead to foot drop. They include:

- Peripheral neuropathy. Diabetes is the most common cause of peripheral neuropathy
- Muscular dystrophy, a group of disorders that cause muscle weakness and loss of muscle tissue.

- Charcot-Marie-Tooth disease is an inherited disorder that affects the peripheral nerves
- Polio is caused by a virus, and can cause muscle weakness and paralysis

Brain and spinal cord disorders can cause muscle weakness and paralysis and include:

- Stroke
- Amyotrophic lateral sclerosis (ALS)
- Multiple sclerosis

### **Symptoms**

Foot drop can cause problems walking. Because you can't raise the front of your foot, you need to raise your leg higher than normal to take a step to avoid dragging your toes or tripping. The foot may make a slapping noise as it hits the ground. This is called a steppage gait.

Depending on the cause of foot drop, you may feel numbness or tingling on the top of your foot or shin. Foot drop may occur in one or both feet, depending on the cause.

### **Exams and Tests**

Your health care provider will perform a physical exam, which may show:

- Loss of muscle control in the lower legs and feet
- Atrophy of the foot or leg muscles
- Difficulty lifting up the foot and toes

Your provider may order one or more of the following tests to check your muscles and nerves and to determine the cause:

- Electromyography (EMG, a test of electrical activity in muscles)
- Nerve conduction tests to see how fast electrical signals move through a peripheral nerve)
- Imaging tests such as MRI, X-rays, CT scans
- Nerve ultrasound
- Blood tests

### **Treatment**

Treatment of foot drop depends on what is causing it. In some cases, treating the cause will also cure foot drop. If the cause is a chronic or ongoing illness, foot drop may be permanent.

Certain people may benefit from physical and occupational therapy.

Possible treatments include:

- Braces, splints, or shoe inserts to help support the foot and keep it in a more normal position.
- Physical therapy can help stretch and strengthen muscles and help you walk better.
- Nerve stimulation may help retrain the nerves and muscles of the foot.

Surgery may be needed to relieve pressure on the nerve or to try to repair it. For long-term foot drop, your provider may suggest fusing the ankle or foot bones. Or you may have tendon surgery. In this, a working tendon and attached muscle is transferred to a different part of the foot.

### **Outlook (Prognosis)**

How well you recover depends on what is causing foot drop. Foot drop will often go away completely. If the cause is more severe, such as stroke, you may not recover completely.

### **When to Contact a Medical Professional**

Call your health care provider if you have trouble walking or controlling your foot:

- Your toes drag on the floor while walking.
- You have a slapping gait (walking pattern in which each step makes a slapping noise).
- You are unable to hold up the front of your foot.
- You have decreased sensation, numbness, or tingling in your foot or toes.
- You have ankle or foot weakness.

### **Foreign object - inhaled**

#### **Definition**

If you breathe a foreign object into your nose, mouth, or respiratory tract, it may become stuck. This can cause breathing problems or choking. The area around the object also can become inflamed or infected.

#### **Alternative Names**

Obstructed airway; Blocked airway

#### **Considerations**

Children ages 6 months to 3 years are the age group most likely to breathe in (inhale) a foreign object. These items may include nuts, coins, toys, balloons, or other small items or foods.

### **Causes**

Young children can easily inhale small foods (nuts, seeds, or popcorn) and objects (buttons, beads, or parts of toys) when playing or eating. This may cause a partial or total airway blockage.

Young children have smaller airways than adults. They also can't move enough air when coughing to dislodge an object. Therefore, a foreign object is more likely to get stuck and block the passage.

### **Symptoms**

Symptoms include:

- Choking
- Coughing
- Difficulty speaking
- No breathing or breathing trouble (respiratory distress)
- Turning blue, red or white in the face
- Wheezing
- Chest, throat or neck pain

Sometimes, only minor symptoms are seen at first. The object may be forgotten until symptoms such as inflammation or infection develop.

### **First Aid**

First aid may be performed on an infant or older child who has inhaled an object. First aid measures include:

- Back blows or chest compressions for infants
- Abdominal thrusts for older children

Be sure you are trained to perform these first aid measures.

Any child who may have inhaled an object should be seen by a doctor. A child with a total airway blockage requires emergency medical help.

If choking or coughing goes away, and the child does not have any other symptoms, he or she should be watched for signs and symptoms of infection or irritation. X-rays may be needed.

A procedure called bronchoscopy may be needed to confirm the diagnosis and to remove the object. Antibiotics and breathing therapy may be needed if an infection develops.

### **Do Not**

DO NOT force feed infants who are crying or breathing rapidly. This may cause the baby to inhale liquid or solid food into their airway.

### **When to Contact a Medical Professional**

Call a health care provider or local emergency number (such as 911) if you think a child has inhaled a foreign object.

### **Prevention**

Preventive measures include:

- Keep small objects out of the reach of young children.
- Discourage talking, laughing, or playing while food is in the mouth.
- Do not give potentially dangerous foods such as hot dogs, whole grapes, nuts, popcorn, food with bones, or hard candy to children under age 3.
- Teach children to avoid placing foreign objects into their noses and other body openings.

## **Fractional excretion of sodium**

### **Definition**

Fractional excretion of sodium is the amount of salt (sodium) that leaves the body through urine compared to the amount filtered and reabsorbed by the kidney.

Fractional excretion of sodium (FENa) is not a test. Instead it is a calculation based on the concentrations of sodium and creatinine in the blood and urine. Urine and blood chemistry tests are needed to perform this calculation.

### **Alternative Names**

FE sodium; FENa

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

Blood and urine samples are collected at the same time and sent to a lab. There, they are examined for salt (sodium) and creatinine levels. Creatinine is a chemical waste product of creatine. Creatine is a chemical made by the body and is used to supply energy mainly to muscles.

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

Eat your normal foods with a normal amount of salt, unless otherwise instructed by your health care provider.

If needed, you may be told to temporarily stop medicines that interfere with test results. For example, some diuretic medicines (water pills) can affect test results.

#### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or slight bruising. This soon goes away.

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

The test is usually done for people who are very ill with acute kidney disease. The test helps determine if the drop in urine production is due to reduced blood flow to the kidney or to kidney damage itself.

#### **What Abnormal Results Mean**

A meaningful interpretation of the test can be made only when your urine volume has dropped to less than 500 mL/day.

FENa of lower than 1% indicates decreased blood flow to the kidney. This can occur with kidney damage due to dehydration or heart failure.

FENa higher than 1% suggests damage to the kidney itself.

#### **Risks**

There are no risks with the urine sample.

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood from some people may be more difficult than from others.

Other risks of having blood drawn are slight, but may include:

- Excessive bleeding
- Multiple punctures to locate veins
- Fainting or feeling lightheaded
- Blood accumulating under the skin (hematoma)
- Infection (a slight risk any time the skin is broken)

#### **Free T4 test**

##### **Definition**

T4 (thyroxine) is the main hormone produced by the thyroid gland. A laboratory test can be done to measure the amount of free T4 in your blood. Free T4 is the thyroxine that is not attached to a protein in the blood.

##### **Alternative Names**

Free thyroxine test; Thyroxine test by equilibrium dialysis

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

A blood sample is needed.

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

Your health care provider will tell you if you need to stop taking any medicines that may affect the test result. In general, test results are not affected by other medicines you may be taking. However, certain supplements including biotin (vitamin B7) can affect the results. Tell your provider if you are taking biotin.

Pregnancy and some diseases, including kidney and liver disease, can also affect the results of this test.

##### **How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

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

Your provider may recommend this test if you have signs of a thyroid disorder, including:

- Abnormal findings of other thyroid blood tests, such as TSH or T3
- Symptoms of an overactive thyroid

- Symptoms of an underactive thyroid
- Hypopituitarism (the pituitary gland does not produce enough of its hormones)
- Lump or nodule in the thyroid
- Enlarged or irregular thyroid gland
- Problems becoming pregnant

This test is also used to monitor people who are being treated for thyroid problems.

#### **Normal Results**

A typical normal range is 0.9 to 2.3 nanograms per deciliter (ng/dL), or 12 to 30 picomoles per liter (pmol/L).

Normal value ranges may vary slightly among different laboratories. Some laboratories use different measurements or may test different specimens. Talk to your provider about the meaning of your specific test results.

The normal range is based on a large population and is not necessarily normal for an individual. You may be having symptoms of hyperthyroidism or hypothyroidism even though your free T4 is in the normal range. The TSH test may help determine if your symptoms are related to thyroid disease. Talk to your provider about your symptoms.

#### **What Abnormal Results Mean**

To fully understand results of the free T4 test, results of other thyroid blood tests, such as TSH or T3, may be needed.

Test results may also be affected by pregnancy, estrogen level, liver problems, more severe body-wide illnesses, and inherited changes in a protein that binds T4.

A higher than normal level of T4 may be due to conditions that involve an overactive thyroid, including:

- Graves disease
- Taking too much thyroid hormone medicine
- Thyroiditis
- Toxic goiter or toxic thyroid nodules
- Some tumors of the testes or ovaries (rare)
- Getting medical imaging tests with contrast dye that contains iodine (rare, and only if there is a problem with the thyroid)
- Eating a lot of foods that contain iodine (very rare, and only if there is a problem with the thyroid)

A lower than normal level of T4 may be due to:

- Hypothyroidism (including Hashimoto disease and other disorders involving an underactive thyroid)
- Severe acute illness
- Malnutrition or fasting
- Use of certain medicines

#### **Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood buildup under the skin)
- Infection (a slight risk any time the skin is broken)

#### **FTA-ABS blood test**

##### **Definition**

The FTA-ABS test is used to detect antibodies to the bacteria *Treponema pallidum*, which causes syphilis.

##### **Alternative Names**

Fluorescent treponemal antibody absorption test

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

A blood sample is needed.

**How to Prepare for the Test**

No special preparation is necessary.

**How the Test will Feel**

When the needle is inserted to draw blood, some people feel moderate pain. Others feel only a prick or stinging. Afterward, there may be some throbbing or a slight bruise. This soon goes away.

**Why the Test is Performed**

This test is done routinely to confirm whether a positive screening test for syphilis (either VDRL or RPR) means you have a current syphilis infection.

It may also be done when other syphilis tests are negative, to rule out a possible false-negative result.

**Normal Results**

A negative or nonreactive result means that you do not have a current or past infection with syphilis.

Normal value ranges may vary slightly among different laboratories. Some labs use different measurements or test different samples. Talk to your health care provider about the meaning of your specific test results.

**What Abnormal Results Mean**

A positive FTA-ABS is often a sign of a syphilis infection. This test result will remain positive for life even if syphilis has been adequately treated. Therefore, it cannot be used to monitor the treatment of syphilis or determine that you have active syphilis.

Other illnesses, such as yaws and pinta (two other kinds of skin diseases), may also result in positive FTA-ABS results. Sometimes, there can be a false-positive result, most often in women with lupus.

**Risks**

There is little risk involved with having your blood taken. Veins and arteries vary in size from one person to another and from one side of the body to the other. Taking blood 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 lightheaded
- Multiple punctures to locate veins
- Hematoma (blood accumulating under the skin)
- Infection (a slight risk any time the skin is broken)