



Bone Densitometry (DEXA)

Bone densitometry, also called dual-energy x-ray absorptiometry or DEXA, uses a very small dose of ionizing radiation to produce pictures of the inside of the body (usually the lower spine and hips) to measure bone loss. It is commonly used to diagnose osteoporosis and to assess an individual's risk for developing fractures. DEXA is simple, quick and noninvasive. It's also the most accurate method for diagnosing osteoporosis.



This exam requires little to no special preparation. Tell your doctor and the technologist if there is a possibility you are pregnant or if you recently had a barium exam or received an injection of contrast material for a CT or radioisotope scan. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown. You should not take calcium supplements for at least 24 hours before your exam.

What is a Bone Density Scan (DEXA)?

Bone density scanning, also called dual-energy x-ray absorptiometry (DEXA) or bone densitometry, is an enhanced form of x-ray technology that is used to measure bone loss. DEXA is today's established standard for measuring bone mineral density (BMD).

An x-ray (radiograph) is a noninvasive medical test that helps physicians diagnose and treat medical conditions. Imaging with x-rays involves exposing a part of the body to a small dose of ionizing radiation to produce pictures of the inside of the body. X-rays are the oldest and most frequently used form of medical imaging.

DEXA is most often performed on the lower spine and hips. In children and some adults, the whole body is sometimes scanned. Peripheral devices that use x-ray or ultrasound are sometimes used to screen for low bone mass. In some communities, a CT scan with special software can also be used to diagnose or monitor low bone mass (QCT). This is accurate but less commonly used than DEXA scanning.

What are some common uses of the procedure?

DEXA is most often used to diagnose osteoporosis, a condition that often affects women after menopause but may also be found in men and rarely in children. Osteoporosis involves a gradual loss of calcium, as well as structural changes, causing the bones to become thinner, more fragile and more likely to break.

DEXA is also effective in tracking the effects of treatment for osteoporosis and other conditions that cause bone loss.

The DEXA test can also assess an individual's risk for developing fractures. The risk of fracture is affected by age, body weight, history of prior fracture, family history of osteoporotic fractures and life style issues such as cigarette smoking and excessive alcohol consumption. These factors are taken into consideration when deciding if a patient needs therapy.

Bone density testing is strongly recommended if you:

- are a post-menopausal woman and not taking estrogen.
- have a personal or maternal history of hip fracture or smoking.
- are a post-menopausal woman who is tall (over 5 feet 7 inches) or thin (less than 125 pounds).
- are a man with clinical conditions associated with bone loss.
- use medications that are known to cause bone loss, including corticosteroids such as Prednisone, various anti-seizure medications such as Dilantin and certain barbiturates, or high-dose thyroid replacement drugs.
- have type 1 (formerly called juvenile or insulin-dependent) diabetes, liver disease, kidney disease or a family history of osteoporosis.
- have high bone turnover, which shows up in the form of excessive collagen in urine samples.
- have a thyroid condition, such as hyperthyroidism.
- have a parathyroid condition, such as hyperparathyroidism.
- have experienced a fracture after only mild trauma.
- have had x-ray evidence of vertebral fracture or other signs of osteoporosis.

The Lateral Vertebral Assessment (LVA), a low-dose x-ray examination of the spine to screen for vertebral fractures that is performed on the DEXA machine, may be recommended for older patients, especially if:

- they have lost more than an inch of height.
- have unexplained back pain.
- if a DEXA scan gives borderline readings.

How should I prepare?

On the day of the exam you may eat normally. You should not take calcium supplements for at least 24 hours before your exam.

You should wear loose, comfortable clothing, avoiding garments that have zippers, belts or buttons made of metal. Objects such as keys or wallets that would be in the area being scanned should be removed.

You will be asked to remove some of your clothes and to wear a gown during the exam. You may also be asked to remove jewelry, removable dental appliances, eye glasses and any metal objects or clothing that might interfere with the x-ray images.

Inform your physician if you recently had a barium examination or have been injected with a contrast material for a computed tomography (CT) scan or radioisotope scan. You may have to wait 10 to 14 days before undergoing a DEXA test.

Women should always inform their physician and x-ray technologist if there is any possibility that they are pregnant. Many imaging tests are not performed during pregnancy so as not to expose the fetus to radiation. If an x-ray is necessary, precautions will be taken to minimize radiation exposure to the baby. See the Safety page for more information about pregnancy and x-rays.

What does the equipment look like?

There are two types of DEXA equipment: a central device and a peripheral device.

Central DEXA devices measure bone density in the hip and spine and are usually located in hospitals and medical offices. Central devices have a large, flat table and an "arm" suspended overhead.

Peripheral devices measure bone density in the wrist, heel or finger and are often available in drugstores and on mobile health vans in the community. The pDEXA device is much smaller than the Central DEXA device, weighing only about 60 pounds. It is a portable box-like structure with a space for the foot or forearm to be placed for imaging. Other portable technologies such as specially designed ultrasound machines, are also sometimes used for screening.

How does the procedure work?

The DEXA machine sends a thin, invisible beam of low-dose x-rays with two distinct energy peaks through the bones being examined. One peak is absorbed mainly by soft tissue and the other by bone. The soft tissue amount can be subtracted from the total and what remains is a patient's bone mineral density.

DEXA machines feature special software that compute and display the bone density measurements on a computer monitor.

How is the procedure performed?

This examination is usually done on an outpatient basis.

In the Central DEXA examination, which measures bone density in the hip and spine, the patient lies on a padded table. An x-ray generator is located below the patient and an imaging device, or detector, is positioned above.

To assess the spine, the patient's legs are supported on a padded box to flatten the pelvis and lower

(lumbar) spine. To assess the hip, the patient's foot is placed in a brace that rotates the hip inward. In both cases, the detector is slowly passed over the area, generating images on a computer monitor.

You must hold very still and may be asked to keep from breathing for a few seconds while the x-ray picture is taken to reduce the possibility of a blurred image. The technologist will walk behind a wall or into the next room to activate the x-ray machine.

The peripheral tests are simpler. The finger, hand, forearm or foot is placed in a small device that obtains a bone density reading within a few minutes.

An additional procedure called Lateral Vertebral Assessment (LVA) is now being done at many centers. LVA is a low-dose x-ray examination of the spine to screen for vertebral fractures that is performed on the DEXA machine.

The LVA test adds only a few minutes to the DEXA procedure.

The DEXA bone density test is usually completed within 10 to 30 minutes, depending on the equipment used and the parts of the body being examined.

You will probably be asked to fill out a questionnaire that will help the doctor determine if you have medical conditions or take certain medications that either increase or decrease your risk of a fracture. The World Health Organization has recently released an online survey that combines the DEXA results and a few basic questions and can be used to predict 10-year hip fracture risk for post-menopausal women. This will be coming into more use in the next few years.

What will I experience during and after the procedure?

Bone density tests are a quick and painless procedure.

Routine evaluations every two years may be needed to see a significant change in bone mineral density, decrease or increase. Few patients, such as patients on high dose steroid medication, may need follow-up at six months.

Who interprets the results and how will I get them?

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

DEXA scans are also interpreted by other physicians such as rheumatologists and endocrinologists. A clinician should review your DEXA scan while assessing the presence of clinical risk factors such as:

- rheumatoid arthritis
- chronic renal and liver disease
- respiratory disease
- inflammatory bowel disease

Your test results will be in the form of two scores:

T score — This number shows the amount of bone you have compared with a young adult of the same gender with peak bone mass. A score above -1 is considered normal. A score between -1 and -2.5 is classified as osteopenia (low bone mass). A score below -2.5 is defined as osteoporosis. The T score is used to estimate your risk of developing a fracture.

Z score — This number reflects the amount of bone you have compared with other people in your age group and of the same size and gender. If this score is unusually high or low, it may indicate a need for further medical tests.

Small changes may normally be observed between scans due to differences in positioning and usually are not significant.

What are the benefits vs. risks?

Benefits

- DEXA bone densitometry is a simple, quick and noninvasive procedure.
- No anesthesia is required.
- The amount of radiation used is extremely small—less than one-tenth the dose of a standard chest x-ray, and less than a day's exposure to natural radiation.
- DEXA bone density testing is the most accurate method available for the diagnosis of osteoporosis and is also considered an accurate estimator of fracture risk.
- DEXA equipment is widely available making DEXA bone densitometry testing convenient for patients and physicians alike.
- No radiation remains in a patient's body after an x-ray examination.
- X-rays usually have no side effects in the typical diagnostic range for this exam.

Risks

- There is always a slight chance of cancer from excessive exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- Women should always inform their physician or x-ray technologist if there is any possibility that they are pregnant. See the Safety page for more information about pregnancy and x-rays.
- The effective radiation dose for this procedure varies. See the Safety page for more information about radiation dose.
- No complications are expected with the DEXA procedure.

A Word About Minimizing Radiation Exposure

Special care is taken during x-ray examinations to use the lowest radiation dose possible while producing the best images for evaluation. National and international radiology protection organizations continually review and update the technique standards used by radiology professionals.

Modern x-ray systems have very controlled x-ray beams and dose control methods to minimize stray

(scatter) radiation. This ensures that those parts of a patient's body not being imaged receive minimal radiation exposure.

What are the limitations of DEXA Bone Densitometry?

- A DEXA test cannot predict who will experience a fracture but can provide indications of relative risk.
- Despite its effectiveness as a method of measuring bone density, DEXA is of limited use in people with a spinal deformity or those who have had previous spinal surgery. The presence of vertebral compression fractures or osteoarthritis may interfere with the accuracy of the test; in such instances, CT scans may be more useful.
- Central DEXA devices are more sensitive than pDEXA devices but they are also somewhat more expensive.
- A test done on a peripheral location, such as the heel or wrist, may help predict the risk of fracture in the spine or hip. These tests are not helpful in following response to treatment, however, and if they indicate that drug therapy is needed, a baseline central DEXA scan should be obtained.

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