Dual energy X-ray absorptiometry

From Wikipedia, the free encyclopedia

Jump to: navigation, search

Dual energy X-ray absorptiometry (**DXA**, previously DEXA) is a means of measuring bone mineral density (BMD). Two X-ray beams with differing energy levels are aimed at the patient's bones. When soft tissue absorption is subtracted out, the BMD can be determined from the absorption of each beam by bone. DXA is the most widely used and most thoroughly studied bone density measurement technology.

Commonly known as a **bone density scan** or **bone densitometry**, DXA scans are used as a screening and diagnostic test for osteoporosis. The bones that are most commonly fractured in humans with osteoporosis are scanned for screening purposes, although osteoporosis can occur in any bone and is not necessarily uniformly distributed in the skeleton. These include the proximal femur, and the lumbar spine. Under some circumstances, the distal radius and ulna are also scanned, usually in obese patients, or those whose orthopedic impairments make scanning of the spine and hips impossible.

In patients who have already sustained a fracture, the DXA scan is used to diagnose osteoporosis if it is suspected. For example, a 50 year old man falls and fractures his hip. The fall is minor enough to suspect some disease of bone may be present. A DXA scan would be used under these circumstances to determine the presence of osteoporosis.

Maximal BMD occurs at age 30 in both males and females. This BMD is used as the standard to which all DXA results are compared. A DXA scan report shows the measured BMD, the difference between the measured BMD and the age-sex matched average, known as the Z score, and the difference between the measured BMD and the sex matched average 30 year old standard, known as the T score. A T score of -1.0 to -2.4 is diagnostic of osteopenia, which confers a modest fracture risk. A T score or -2.5 or less is indicative of osteoporosis.

DXA scans can also be used to measure total body fat content, which is useful for athletes, models and health-conscious people.

Special considerations are involved in the use of DXA to assess bone mass in children. Specifically, comparing the bone mineral density of children to the reference data of adults (to calculate a T-score) will underestimate the BMD of children, because children have less bone mass than fully developed adults. This would lead to an overdiagnosis of osteopenia for children. To avoid an overestimation of bone mineral deficits, BMD scores are commonly compared to reference data for the same gender and age (by calculating a z-score).

Also, there are other variables in addition to age which are suggested to confound the interpretation of BMD as measured by DXA. One important confounding variable is bone size. DXA has been shown to overestimate the bone mineral density of taller subjects and underestimate the bone mineral density of smaller subjects. This error is due to the way in which DXA calculates BMD. In DXA, bone mineral content (measured as the attenuation of X-ray by the bones being scanned) is divided by the area (also measured by the machine) of the site being scanned.

Because DXA calculates BMD using area (aBMD: areal bone mineral density), it is not an accurate measurement of true bone mineral density, which is mass divided by a volume.[1] The confounding effect of differences in bone size is due to the missing depth value in the calculation of bone mineral density.[2]Methods to correct for this shortcoming include the calculation of a volume which is approximated from the projected area measure by DXA. DXA BMD results adjusted in this manner, are referred to as the bone mineral apparent density (BMAD) and are a ratio of the bone mineral content versus a cuboidal estimation of the volume of bone. Like aBMD, BMAD results do not accurately represent true bone mineral density, since they use approximations of the bone's volume.[3]

BMAD is used primarily for research purposes and is not used in clinical settings, yet.

Information for Patients

DXA uses X-rays to assess bone mineral density, however the radiation dose is approximately 1/30th that of a standard chest X-ray.

The quality of DXA operators varies widely. DXA is not regulated like other radiation based imaging techniques because of its low dosage. Each state has a different policy as to what certifications are needed to operate a DXA machine. California for example requires coursework and a state-run test, whereas Maryland has no requirements for DXA technicians. Many states require a training course and certificate from the International Society of Clinical Densitometry (ISCD). Because BMD testing with DXA is very susceptible to operator error (it is not fool-proof) it is important to find out what qualifies the technician to operate the machine.

It is important for patients to get repeat BMD measurements done on the same machine each time, or at least a machine from the same manufacturer. Error between machines, or trying to convert measurements from one manufacturer's standard to another can introduce errors large enough to wipe out the sensitivity of the measurements.

Notes

[edit]

1. ↑ In order to distinguish DXA BMD from volumetric bone-mineral density, researchers sometimes refer to DXA BMD as an areal bone mineral density (aBMD).
2. ↑ It should be noted that despite DXA technology's problems with estimating volume, it is still a fairly accurate measure of bone mineral content.
3. ↑ Other imaging technologies such as Computed Quantitative Computer Tomography (QCT)are capable of measuring the bone's volume, and are therefore not susceptible to the confounding effect of bone-size in the way that DXA results are susceptible.

External links

[edit]

- Information for patients, from RSNA
- Bone Densitometry explained
- DEXA Scan - information at Got Bones?

Category: Radiology

Views

- Article
- Discussion
- Edit this page
- History

Personal tools

- Sign in / create account

Navigation

- Main Page
- Community Portal
- Featured articles
- Current events
- Recent changes
- Random article
- Help
- Contact Wikipedia

- Donations

Search

Go Search

Toolbox

- What links here
- Related changes
- Upload file
- Special pages
- Printable version
- Permanent link
- Cite this article

In other languages

- Polski
- Français